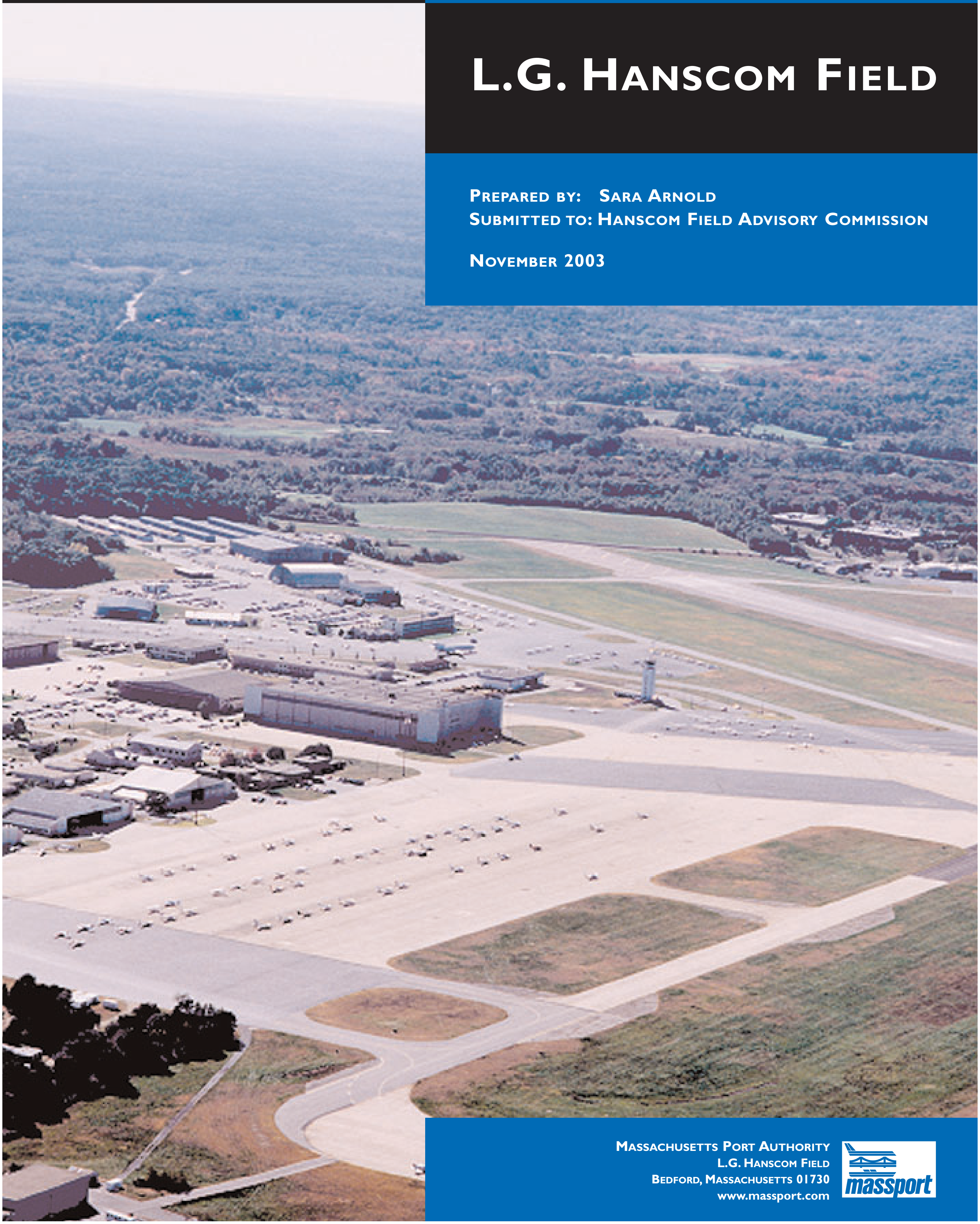
2002

Noise Exposure Levels at

L.G. Hanscom Field



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INTRODUCTION -- L. G. HANSCOM FIELD

L. G. Hanscom Field, sometimes referred to as the Bedford airport (BED), is a general aviation airport, located northwest of Boston, Massachusetts and geographically bounded by Bedford, Concord, Lexington and Lincoln. Although the land was purchased by the state for development of an airfield, the original runways and facilities were constructed in 1941 by the military in support of America's war effort, and the Army Air Corps leased the land for advanced pilot training.

In the 1950s, the Massachusetts Port Authority (Massport) was granted control of the land by the state legislature. Massport managed the civil terminal area while the Air Force leased and operated the airfield for continued use by military and civilian aircraft. In 1974, the Air Force canceled its lease, and Massport was granted control of the airport's operation and maintenance. While the Air Force continues to own land adjacent to the airfield, military aircraft operations represent less than one percent of the activity.

Consistent with its role for over two decades, Hanscom Field functions as a general aviation reliever airport for Logan International Airport, while providing limited commercial service. It contributes to the regional transportation system in two ways:

1. It eases Logan congestion by handling general aviation (G.A.) aircraft operations. Currently there are approximately 200,000 G.A. operations per year. These include private, pilot training, business, charter, cargo, and air taxi operations, all of which serve the diverse flying needs of corporations, research and development firms, and educational institutions, as well as individuals and small businesses.

2. It provides the traveling public with an alternative airport by offering limited commercial service to select markets. Consistent with Massport's 1980 Regulations, commuter activity has been periodically available at Hanscom in aircraft with no more than 60 seats. After seven years without commuter service, Shuttle America began serving Hanscom in September 1999. In 2002, it carried 67,513 passengers in and out of Hanscom on 6375 flights. Boston-Maine Airlines began service in July 2002 and carried 175 passengers in and out of Hanscom on 228 flights before the end of the year.

The total number of Hanscom operations has fluctuated over the years. Prior to 1970, operations steadily increased, with FAA tower counts peaking at over 300,000 in 1970. After declines in activity during the 1970s, the FAA tower counts ranged from just under 214,000 to almost 250,000 in the 1980s. The depressed economy in the early 1990s caused activity to drop to fewer than 200,000 operations by 1993, and they remained below 200,000 until 2000. Hanscom experienced 218,248 operations in 2002.

The airport is seen as a regional economic asset, which plays a vital role in the Massachusetts economy and in the regional transportation system. Both the residential and aviation communities take great interest in the planning and operation of the airport. The annual noise report is one tool used by Massport to report on the activity at Hanscom Field.

CHAPTER 1 SUMMARY

The first noise report for L.G. Hanscom Field was prepared in 1982, and it compared data for 1978 and 1981. Annual updates were started in 1984 (for the previous year's data), making this the twenty-first Hanscom noise report. It compares 2002 activity data with data for the previous study years (1978, 1981, and 1983 through 2001). For almost twenty-five years, 1978 has been used as the base year for evaluating changes in noise exposure. Chapter 2 explains how this has been done despite updates in the noise and performance data used to calculated noise exposure at Hanscom Field. Data from those twenty plus years provide an historical perspective. In this report, new noise and performance data were used to calculate noise exposure for 2000 through 2002. These data are used to show the most current trends.

In response to input from aviation and residential representatives, the most recent annual reports have focused on the noise impact of civilian aircraft departures, including single engine piston aircraft. There is supplemental information on total numbers of operations, fleet mix, 11 p.m. to 7 a.m. activity, the effect of military operations, and arrival noise levels. EXP, a metric that estimates cumulative noise exposure at Hanscom, is used as a screening tool to evaluate changes in the overall noise level. This report also includes eight years of data from the permanent noise monitoring system that was installed in the early to mid-1990s.

Massport's data management system compiles information from a number of sources and develops the operations and noise data discussed in this report. Results of this evaluation show the following:

1. For activity between 7 a.m. and 11 p.m., 2002 Federal Aviation Administration (FAA) Tower counts, including all arrivals and departures for both civilian and military aircraft, show 218,248 operations. This is an increase of 6.2 percent as compared to 2001.

2. The civilian portion of the FAA tower counts, which dominates the total activity, increased 6.2 percent in 2002 as compared to 2001. This is attributable to increases in all categories of civilian aircraft. The largest increase was in business jet activity, which increased 34.8 percent. This is a reflection of the over 50 percent increase in jet activity that occurred in the twelve months following September 11, 2001.

3. Military flights, which represented less than one percent of the total activity, increased 13.7 percent in 2002 as compared to 2001. The Hanscom Air Force Base sponsored an Air Show in June of 2002 that influenced the increase.

4. Non-single engine piston (non-SEP) civilian aircraft averaged 79.96 daily departures in 2002, the highest of all the study years. This was an increase of 17.5 percent as compared to 2001. The increase included more business jet operations, which represented 11.1 percent of the aircraft activity in 2001 and 14.1 percent of the activity in 2002. At the same time, the percentage of Stage 2 jet operations (the noisiest civilian aircraft) decreased from 11 percent in 2000 to six percent in 2002.

5. Operations by single engine piston aircraft in 2002 exceeded 2001 by 2.8 percent. This was a reflection of the 2001 decline in this activity more than a reflection of an upward trend. There were FAA restrictions between September 11, 2001 and November 28, 2001 that curtailed operations by small aircraft. In 2002, this activity was below levels experienced through the 1980s, below most levels experienced during the 1990s, and below 2000.

6. Use of the airfield between 11 p.m. and 7 a.m. increased from 1,674 operations in 2001 to 2,170 operations in 2002. Jets (49.7 percent) and helicopters (26.4 percent) dominated these aircraft arrivals and departures. A nighttime field use fee was instituted in 1980 to discourage use of the field during these noise sensitive hours; the fee doubles after five operations in a calendar year; and the fee is adjusted each July 1 based on the Consumer Price Index. Of the 749 civilian aircraft that were subject to the fee, 39 conducted more than five operations. There were 635 exempt operations, of which almost 89 percent were medical flights.

7. Using EXP Version 6.0c, the 2002 departure noise exposure for civilian aircraft was 112.4 decibels (dB), an increase of 0.8 dB as compared to 2001. A combination of resources to track noise levels since 1978, indicate that noise exposure for 2002 is 1.2 to 1.4 dB above the 1978 base year. In 2002, civilian aircraft contributed 81 percent to the total noise exposure. Military aircraft, which conducted less than one percent of the activity, contributed 19 percent to the noise level.

8. This report includes an eight-year comparison of noise levels recorded at six noise-monitoring sites located in the communities and on the airfield. 1995 was the first year that data was collected consistently from all six sites. The reported noise levels include civilian and military aircraft noise as well as community noise. When comparing 2001 to 2002, the monitors show increases ranging from 0.6 dB to 1.3 dB at five of the sites and a decrease of 1.7 dB at the other location.

9. The 1978 *Hanscom Field Master Plan and Environmental Impact Statement* (The Master Plan) and the *General Rules and Regulations for Lawrence G. Hanscom Field*, effective 1980, include the policies and regulations that guide Massport as it operates

Hanscom Field. In addition, Massport staff work closely with the Hanscom Field Advisory Commission (HFAC) and the Hanscom Area Towns Committee (HATS), as well as other concerned parties, in an effort to balance its commitment to regional transportation and the business community with the need to recognize and minimize the airport's impact on the surrounding communities.

CHAPTER 2 HISTORICAL PERSPECTIVE ON THE ANNUAL REPORT AND THE EVALUATION OF NOISE

This report has been prepared by Massport to present data for 2002 operations at Hanscom Field and to evaluate their effect on the noise environment around the airport. Consistent with previous annual reports, this report includes an historical perspective on why and how noise impact reports have been presented since 1982, and continues with data on the numbers and types of operations and overall noise exposure for the most recent calendar year. Information from previous years is included to show trends in aviation activity. Along with informing the public of Hanscom's operations and noise exposure, the annual reports respond to questions and ideas raised at meetings with the HFAC, a committee consisting of representatives from the surrounding communities, area-wide organizations, airport users, and Ex Officio members from the FAA, Hanscom Air Force Base, and Minute Man National Historic Park, as well as Massport.

This chapter discusses the development of measures used to evaluate noise exposure at the Bedford airport. Each step was discussed with the HFAC, and the current approach was adopted through general consensus at the HFAC meetings.

The first noise report was prepared in 1982 by Harris Miller Miller and Hanson Inc. (HMMH), noise consultants for Massport. The firm continued to prepare noise reports until 1987, when Massport assumed the responsibility. In preparing the annual document, Massport utilizes the basic approach and format of the HMMH reports and includes some background information written by HMMH.

Each year, Massport has a noise consultant review the noise data and report. Harris Miller Miller and Hanson reviewed the data and report in 2002.

2.1 The Use of Ldn to Evaluate Noise Exposure

The primary purpose of the first noise report was to evaluate the effectiveness of the noise rules that Massport had implemented in 1980, by determining changes in the noise environment between 1978 and 1981. The most frequently used measure to characterize noise exposure around an airport is referred to as the Day-Night Average Sound Level (Ldn or DNL), which

uses contours on a map to connect points of equal noise exposure. Creating Ldn contours requires detailed knowledge of the fleet of aircraft using the airport, the types of aircraft engines, the climb performance characteristics, information on the frequency of runway use, and the flight paths of the aircraft as they depart and approach the field. These data are entered into a computer noise model to produce the contours.

Ldn is used widely throughout the United States, and is discussed in more depth in Appendix A. Appendix A also includes maps from previous studies showing the 1978, 1987, 1995 and 2000 Ldn contours and 2000 Time Above contours for Hanscom. The 1978 contours were developed in 1981 using the computerized modeling program called Noisemap; the 1987 contours were developed in 1988 using INM 3.9; the 1995 contours were developed in 1996 using INM 5.0; and the 2000 contours were developed in 2002 using INM 6.0c. The contours include the effects of civil and military aircraft as well as touch-and-goes, a procedure used by flight schools to train students to land and depart.

2.2 Developing EXP to Evaluate Changes in Noise Exposure

In addition to creating Ldn contours, HMMH used the 1982 report to define a screening procedure, or metric, that could be used readily to evaluate the effect of changes in the fleet mix and number of operations. A database management system was developed to calculate the metric (called EXP), which has been used since 1982 as a first-round screening procedure.

Although EXP does not show how noise levels change in specific communities, it does provide a tool for distinguishing civilian noise from military noise and for indicating changes in the total noise exposure, which reflect expected changes in Ldn. This is accomplished by having EXP use the same FAA noise data for the aircraft types, and the same manner of logarithmically summing noise used in calculating Ldn. This includes the weighting of 10 p.m. to 7 a.m. aircraft events as if they were ten decibels louder than comparable daytime events to account for their more intrusive nature.

Each aircraft model is assigned to a group, with each group characterized by a similarity of size, the number and type of engine(s), climb performance, and ultimately, noise level characteristics. Using FAA noise and performance data, arrival and departure Sound Exposure Levels (SEL) are assigned to each group. The SELs used for EXP represent the amount of noise generated 15,000 feet from start of take-off roll. There is additional discussion of SEL in Appendix A.
The total departure noise exposure on an average day is calculated for each group by

1. Logarithmically multiplying the representative SEL for the group by the average number of departures by those aircraft, weighting the 10 p.m. to 7 a.m. operations, and creating a "partial" departure EXP; and

2. Logarithmically adding all "partial" EXPs for the entire fleet to obtain a single number estimate of departure noise exposure.

Appendix A describes the EXP methodology in more depth. All EXP values are in A-weighted decibels.

2.3 The Significance of Changes in EXP

Periodically EXP has been reviewed to validate its continued use as an estimate of corresponding changes in Ldn, and it has been concluded that changes in EXP and contour values show good agreement. Thus, EXP continues to be used as a first round procedure to estimate changes in noise levels at Hanscom. In the mid-1980s, HFAC and Massport discussed the significance of changes in EXP, and it was agreed that an increase of 1.5 dB above the 1978 base year noise level would indicate the need for further study.

Although EXP has never exceeded 1.5 dB above 1978, Massport completed a Generic Environmental Impact Report (GEIR) in 1988, an update of the GEIR in 1997, and a further update, entitled the Environmental Status and Planning Report (ESPR), based on 2000 data, in 2003. The original GEIR, its update, and the ESPR include noise contours and additional noise metrics, providing comprehensive analyses of noise impacts. Furthermore, it is anticipated that updates of the ESPR, with detailed noise analyses will be conducted every five years regardless of the increases or decreases in EXP.

It is increasingly difficult to compare current noise levels to noise levels from almost 25 years ago because the FAA periodically updates the Integrated Noise Model, which is the basis of calculating EXP. However, EXP still allows for an annual evaluation of <u>changes</u> in the noise level from one year to the next and identifies <u>trends</u> in those changes.

2.4 Upgrading EXP Calculations

Until 1987, the EXP calculations primarily relied on SELs from the U.S Air Force's Noisemap noise and performance data, which were available in 1982 when EXP was developed. In 1987, the FAA released a revised and expanded set of noise and performance data (Version 3.9) for the Integrated Noise Model (INM) for aircraft noise modeling, and the FAA continues to support a process of updating its aircraft noise and performance data.

Starting in 1987, EXP calculations have been based on data from the INM, and the FAA upgrades have resulted in periodically upgrading the SEL values used in EXP. From 1987 to 1996, EXP Version 3.9 (EXP 3.9) was used. EXP Version 5.1 (EXP 5.1) was started in 1996, and EXP Version 6.0c is being introduced in this report. There is a detailed explanation of the first two changes in the reports <u>1988 Noise Exposure Levels at L. G. Hanscom Field</u> and <u>1996</u>

Noise Exposure Levels at L. G. Hanscom Field, available through Massport. Chapter 6 in this report (2002) summarizes those changes, discusses the change to Version 6.0c, and discusses the impacts on EXP.

2.5 EXP Focus: With Single Engine Piston (SEP) vs. Without SEP, With Military Aircraft vs. Without Military Aircraft, Departure EXP vs. Arrival EXP

When EXP was first developed it was calculated for civilian and military non-SEP aircraft departures with the capability of using either subgroup for comparison. SEP operations were excluded from the data for reasons discussed in the early reports. When residents became interested in the noise impact of these small aircraft, a method for estimating their usage was developed and applied to all the study years.

In 1988, HFAC members discussed the need to focus on one number when comparing EXP from one year to the next. It was agreed that since Massport does not have jurisdiction over military operations, the emphasis should be on civilian aircraft, and the civilian component should include the estimated SEP operations. It was also agreed that Massport would begin to track arrival EXP, although the focus on departures would still be used as the best representation of the noise impact since changes in departure EXP more closely reflect changes in Ldn than do changes in arrival EXP.

2.6 The Report on 2002 Noise Exposure

This report incorporates the results of the agreed upon methodology for evaluating the noise impact, as it applies to 2002 Hanscom operations. It focuses on the effect of civilian aircraft departures, including SEP, with supplementary information on total numbers of operations, the impact of military activity, 11 p.m. to 7 a.m. operations, and arrival EXP. It includes operational data for the study years (1978, 1981 and 1983 through 2002) and evaluates the change in noise exposure since 1978. EXP is still considered a good indicator of changes in Ldn and changes in the general level of total noise exposure generated by the airport. Furthermore, it provides an historical perspective, since comparative data are available for most years since 1978. Data from the permanent noise monitoring system became available during the 1990s, providing additional information on the measured noise experience at six locations.

Methods of data collection for determining operations and noise exposure are reviewed in Chapter 3. A discussion of the 7 a.m. to 11 p.m. operational levels for 2002 are presented in Chapter 4, while Chapter 5 focuses on operations conducted between 11 p.m. and 7 a.m. when a nighttime field use fee is in effect. Chapter 6 presents noise exposure levels (using the EXP noise metric), and Chapter 7 discusses the permanent noise monitoring system and the data

generated by the system. Massport policies that address the noise impacts that concern the surrounding communities, are reviewed in Chapter 8.

CHAPTER 3 DATA COLLECTION FOR DETERMINING OPERATIONS AND NOISE EXPOSURE

Hanscom Field serves various categories of civilian and military aircraft, and data are compiled to track their noise impact. Massport's data management system uses a set of files of aircraft operational information and estimates to summarize activity levels, identify aircraft operations subject to nighttime field use fees, and compute estimates of resulting noise exposure. Because the Bedford FAA control tower is only open from 7 a.m. to 11 p.m., and because the tower does not have a written record for every operation, input to the files used to develop operations and noise data come from several sources, as follows:

1. FAA Flight Strips: used to record non-SEP Instrument Flight Rule (IFR) departures from Hanscom between 7 a.m. and 10 p.m. and all IFR arrivals and departures between 10 p.m. and 11 p.m.

Pilots fly using either IFR or Visual Flight Rule (VFR) procedures. When flying IFR, a flight plan is filed with the FAA, resulting in a flight strip identifying the aircraft type and time of the operation at the origin and destination FAA towers. When there is VFR weather, pilots may choose to fly without filing a flight plan. The majority of jets fly IFR, regardless of the weather. Many turboprops and twins also fly IFR.

2. FAA Monthly Tower Reports: used to provide the number of aircraft operations at Hanscom Field between 7 a.m. and 11 p.m.

The Bedford FAA tower personnel maintain a count of all aircraft that operate at Hanscom when the tower is open. This includes VFR and IFR arrivals and departures. Prior to 1993, it also included aircraft that flew through the Hanscom air space but did not use the airport (overflights). The FAA tower count is traditionally used to quantify the activity level for the airport, despite the previous inclusion of overflights and the exclusion of operations between 11 p.m. and 7 a.m. when the FAA tower is closed.

3. Estimates of Civilian VFR non-SEP Aircraft: used to supplement IFR activity by civilian twin-engine pistons (twins), turboprops (turbos), and helicopters between 7 a.m. and 10 p.m.

Pilots of some turboprops and twin-engine aircraft and most helicopters fly VFR. They communicate with the FAA tower, and the tower tallies the operation, although there is no written record of the aircraft type or specific time of the operation. Estimates are

incorporated into the database programs to provide a reasonable representation of VFR operations by civilian non-SEP aircraft types between 7 a.m. and 10 p.m.

4. An Estimate of Civilian SEP Activity Between 7 a.m. and 10 p.m.

The number of civilian SEP aircraft operations is estimated by subtracting the civilian IFR and estimated flights for jets, helicopters, twins, and turbos from the Tower counts for non-military operations. Prior to 1993, the FAA Tower counts included all communications with aircraft that flew through the Hanscom air space, whether or not they used Hanscom, making the estimated number of SEP operations derived by this method conservatively high. Starting in 1993, the approximations are closer to the actual number of arrivals and departures since overflights are no longer counted.

5. Nighttime Field Use Logs: Massport records all operations between the hours of 11:00 p.m. and 7:00 a.m. when the FAA tower is closed.

Table 3.1 summarizes the sources of data used to track operational activity by aircraft type, as discussed above.

TABLE 3.1 Data Sources for Civilian Aircraft

	7 a.m.-10 p.m.	10 p.m.-11 p.m.	11 p.m.-7 a.m.
DEPARTURES: Non-SEP	FAA flight strips + formulas to estimate civilian VFR turbos, twins & helicopters	FAA flight strips	Massport records
SEP	FAA count for non-military operations minus civilian non-SEP IFR & estimated VFR activity	FAA flight strips	Massport records
ARRIVALS:	Difference between total departures & 10 p.m.-7 a.m. arrivals	FAA flight strips	Massport records

CHAPTER 4 2002 OPERATIONS, 7 a.m.-11 p.m.

As discussed in Chapter 3, the FAA tower counts are traditionally used to report the official number of operations for an airport. At Hanscom, they include military operations and, until 1993, an unidentified percentage of overflights. Because the Tower is not open from 11 p.m. to 7 a.m., the counts do not include operations conducted between those hours. Including night (11

p.m. to 7 a.m.) operations would increase the total by less than one percent. Night activity is discussed in Chapter 5.

Table 4.1 presents the Hanscom Tower counts since 1978, showing 218,248 operations for 2002. This represents a 6.2 percent increase in activity as compared to 2001. This was the third consecutive year that activity exceeded 200,000 annual operations. From 1993 through 1999 tower counts were below 200,000, but between 1962 and 1992 Tower counts consistently exceeded 200,000 and in 1970 they exceeded 300,000.

TABLE 4.1 Annual FAA Tower Counts for 7 a.m. to 11 p.m. Since 1978

Year	Tower Count	Year	Tower Count
1978	235,750	1991	213,637
1979	225,805	1992	203,755
1980	218,502	1993	196,138
1981	213,698	1994	187,550
1982	215,984	1995	190,282
1983	219,466	1996	179,497
1984	229,130	1997	188,087
1985	247,434	1998	183,185
1986	232,110	1999	197,302
1987	239,154	2000	212,371
1988	228,725	2001	205,436
1989	238,340	2002	218,248
1990	232,678		

The tower counts in **Table 4.1** have been plotted in **Figure 4.1** to illustrate the annual fluctuations since 1978, including the high of 247,434 operations in 1985 and the 1996 low of 179,497 operations.

FIGURE 4.1 Annual FAA Tower Counts for 7 a.m. to 11 p.m. Since 1978

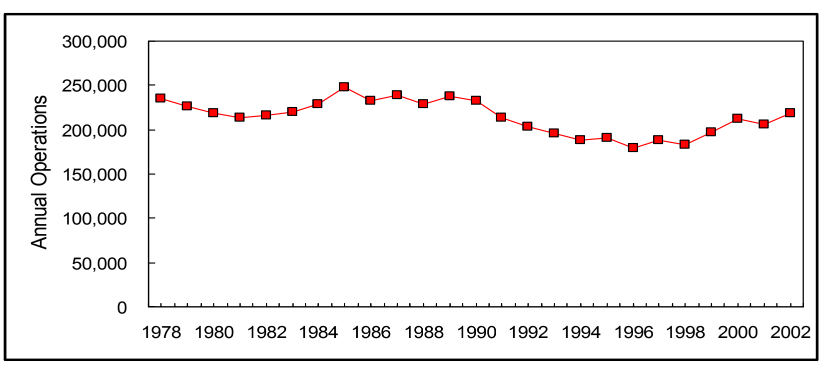


Table 4.2 shows a summary of the estimated average daily departures by aircraft other than SEP. These departures have been separated by day and night hours for both civilian and military aircraft and are listed month-by-month to show seasonal variations in activity. Night hours are defined as 10 p.m. to 7 a.m., consistent with the night definition used in noise exposure calculations for Ldn and EXP, as discussed in Appendix A.

TABLE 4.2 2002 Monthly Average Daily Departures by non-Single Engine Piston Aircraft

	CIVILIAN			MILITARY			CIVILIAN & MILITARY		
	DAY	NIGHT	TOTAL	DAY	NIGHT	TOTAL	DAY	NIGHT	TOTAL
Jan	71.59	3.32	74.91	0.97	0.00	0.97	72.56	3.32	75.88
Feb	81.98	4.03	86.01	1.43	0.04	1.47	83.41	4.07	87.48
Mar	79.14	3.29	82.43	1.19	0.00	1.19	80.33	3.29	83.62
Apr	84.73	3.60	88.33	2.50	0.03	2.53	87.23	3.63	90.86
May	82.59	3.55	86.14	1.35	0.00	1.35	83.94	3.55	87.49
Jun	79.80	3.43	83.23	3.23	0.06	3.29	83.03	3.49	86.52
Jul	73.95	3.42	77.37	1.68	0.13	1.81	75.63	3.55	79.18
Aug	73.01	2.80	75.81	1.61	0.03	1.64	74.62	2.83	77.45
Sep	75.20	4.70	79.90	2.53	0.00	2.53	77.73	4.70	82.43
Oct	78.49	4.06	82.55	1.87	0.06	1.93	80.36	4.12	84.48
Nov	72.53	2.77	75.30	1.07	0.00	1.07	73.60	2.77	76.37
Dec	65.72	2.71	68.43	0.58	0.00	0.58	66.30	2.71	69.01
2002	76.50	3.46	79.96	1.66	0.03	1.69	78.16	3.49	81.65

These data show that, in 2002, almost 98 percent of the estimated departures in multi-engine aircraft and helicopters (i.e. non-SEP aircraft) were civilian operations. The remaining two percent were military. The busiest month for civilian non-SEP activity was April, with an average of 88.33 daily departures, while the low occurred in December with only 68.43 civilian non-SEP departures. The civilian non-SEP activity averaged 79.96 departures during the year. Military activity peaked in June with 3.29 departures. This was influenced by the June Air Show that was sponsored by Hanscom Air Force Base. The lowest military level was in December with 0.58 departures. Military non-SEP activity averaged 1.69 departures during the year.

Total civilian and military activity levels peaked in April, when there were 90.86 average daily departures for non-SEP activity, reflecting the civilian dominance of aircraft operations. The slowest month was December, with 69.01 civilian and military average daily departures. Total non-SEP activity averaged 81.65 departures during the year.

Figure 4.2 shows a plot of the data in **Table 4.2**. It demonstrates the monthly variability of non-SEP departures, including the April high and the December low. It also demonstrates the influence of weather; activity tends to decline during the winter months.

FIGURE 4.2 Monthly Variations in Activity by Multi-engine Aircraft & Helicopters, 2002

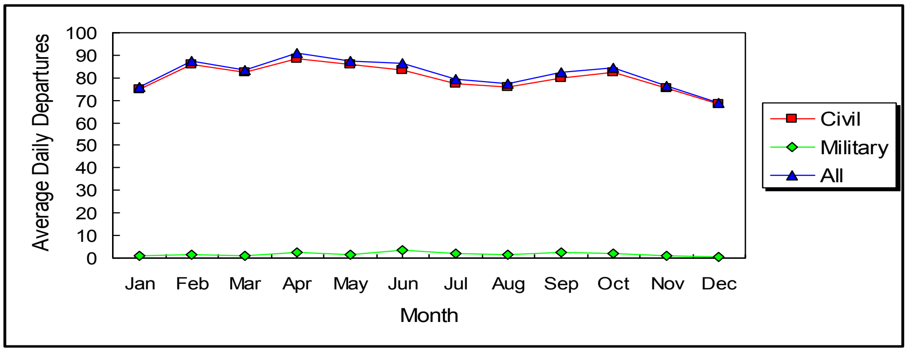


Table 4.3 shows the comparison of the 2002 data for non-SEP activity to previous study year totals. The 79.96 civilian average daily departures is the highest of all the study years and is 17.5 percent greater than the 2001 civilian average daily departures. The 1.69 military daily departures, is 8.3 percent greater than in 2001 but is below the 2.11 military average for the study years. Military departures have never represented more than 8.0 percent of the non-SEP departures in any study year to-date.

TABLE 4.3 Annual Average Daily Departures by Aircraft other than Single Engine Piston

	CIVILIAN			MILITARY			CIVILIAN & MILITARY		
	DAY	NIGHT	TOTAL	DAY	NIGHT	TOTAL	DAY	NIGHT	TOTAL
1978	35.55	2.11	37.66	3.32	0.03	3.35	38.87	2.14	41.01
1981	45.77	1.44	47.25	3.24	0.04	3.28	49.01	1.48	50.49
1983	39.82	0.91	40.73	1.76	0.01	1.77	41.58	0.92	42.50
1984	40.63	1.72	42.35	1.12	0.01	1.13	41.75	1.73	43.48
1985	38.68	0.73	39.41	2.22	0.04	2.26	40.90	0.77	41.67
1986	37.02	0.67	37.70	1.81	0.03	1.84	38.83	0.69	39.52
1987	39.61	1.00	40.61	2.13	0.04	2.17	41.75	1.04	42.79
1988	43.67	1.73	45.40	2.15	0.08	2.23	45.82	1.83	47.65
1989	42.72	1.71	44.43	2.45	0.08	2.53	45.17	1.78	46.95
1990	39.61	1.16	40.77	1.77	0.06	1.83	41.38	1.22	42.60
1991	37.27	1.00	38.27	2.39	0.13	2.52	39.66	1.13	40.79
1992	34.48	1.03	35.51	2.24	0.06	2.30	36.72	1.09	37.81
1993	33.55	0.90	34.45	2.49	0.11	2.60	36.04	1.02	37.06
1994	33.99	0.92	34.91	2.12	0.08	2.20	36.10	1.01	37.11
1995	34.01	1.15	35.16	2.06	0.10	2.16	36.07	1.24	37.31
1996	35.25	1.70	36.95	1.74	0.09	1.83	36.99	1.79	38.78
1997	35.38	2.04	37.42	1.75	0.04	1.79	37.12	2.08	39.20
1998	41.71	2.05	43.76	2.08	0.11	2.19	43.79	2.16	45.95
1999	46.31	2.27	48.58	1.81	0.04	1.85	48.12	2.31	50.43
2000	60.83	2.91	63.74	1.35	0.06	1.41	62.18	2.97	65.15
2001	65.27	2.77	68.04	1.56	0.00	1.56	66.83	2.77	69.60
2002	76.50	3.46	79.96	1.66	0.03	1.69	78.16	3.49	81.65

Figure 4.3 plots the annual non-SEP departure activity for the study years from 1978 to 2002, demonstrating the fluctuations that have been experienced over the past 24 years. It shows that after decreases in non-SEP activity starting in 1989 and continuing in the early 1990s, the levels remained stable through 1997. It also shows that the 1998 non-SEP departures returned to a level comparable to those experienced in the late 1980s; and the 2000 non-SEP departures increased to 63.74 departures primarily due to the reintroduction of commuter service in late 1999. After September 11, 2001, there was a surge in business jet activity, which is reflected in the non-SEP 2001 and 2002 levels. These rose to 68.04 and 79.96 respectively.

FIGURE 4.3 Annual Variations in Average Daily Departures by Aircraft other than SEP

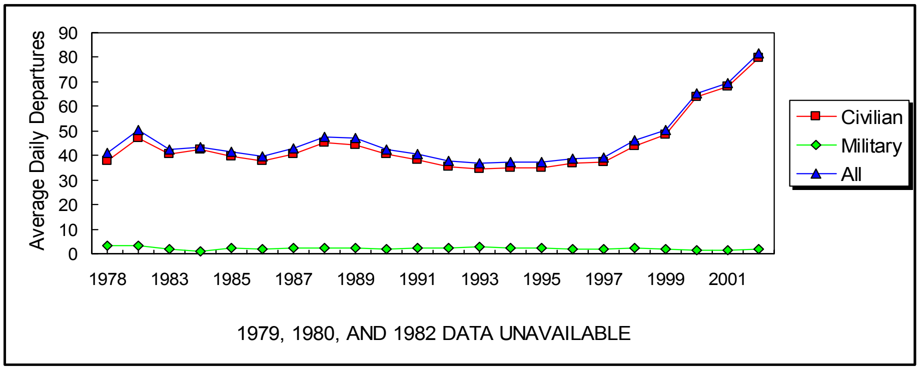


Table 4.4 shows the estimated SEP aircraft activity between 7 a.m. and 11 p.m. for the study years starting in 1978. The 219.8 average daily departures in 2002 is a 2.84 percent increase above 2001, but remains below the 227.0 daily departures in 2000. The study year with the lowest level of estimated average daily SEP departures was 1998 with 206.2 average SEP departures. The highest study year for SEP activity was 1985 with 297.3 estimated 7 a.m. to 11 p.m. average daily departures.

TABLE 4.4 Estimated Average Daily Departures*, 7 a.m.-11 p.m. by Single Engine Piston Aircraft for Study Years

Year	SEP Departures	Year	SEP Departures
1978	282.0	1992	240.2
1981	242.6	1993	231.1
1983	258.0	1994	219.8
1984	270.4	1995	223.0
1985	297.3	1996	207.2
1986	278.4	1997	218.9
1987	284.2	1998	206.2
1988	264.9	1999	221.6
1989	280.1	2000	227.0
1990	276.0	2001	213.7
1991	251.1	2002	219.8

*Estimated Average Daily Departures = Total Annual Operations from FAA tower counts divided by two, minus the daily departures of aircraft other than single engine piston aircraft divided by 365 days (366 in a leap year).

While the use of small aircraft continues to dominate Hanscom's activity, it was particularly impacted by the depressed economy in the early 1990s, and activity by this category of aircraft has not fully recovered. It suffered an additional setback after September 11, 2001.

The estimate for SEP operations includes touch-and-go, or "local," activity, which peaked in 1978 when the FAA logged 94,641 touch-and-goes. This is the pattern used to practice landing and departing, mostly conducted by the flight schools. The aircraft is brought in for a landing, continues on the runway for a departure, circles the field and repeats the procedure without stopping. The FAA tower tallies each touch-and-go as two operations, since there is an arrival and a departure. The reason the touch-and-go operations are included in the estimates for single engine piston aircraft activity is because since 1980 touch-and-goes have not been allowed in aircraft over 12,500 pounds at Hanscom, and they are mostly conducted by flight schools, which use SEP aircraft.

The FAA tallies "local" operations and military activity as separate categories in its monthly counts. Starting in 1987, this information has been combined with the data collected in the database system in order to estimate the breakdown of 7 a.m. to 11 p.m. civilian activity by aircraft type for both IFR and VFR operations, as shown in **Table 4.5**.

TABLE 4.5 Annual Estimated Operations by Aircraft Type, 7 a.m.-11 p.m.

	CIVILIAN						MILITARY	TOTAL
	Local	Singles	Twin Piston	Turbo	Jet	Heli		
1987	72,999	134,461	5,309	6,443	10,034	7,294	2,613	239,153
1988	66,669	127,233	5,968	8,800	10,216	7,258	2,581	228,725
1989	72,067	132,368	5,697	8,767	9,656	7,294	2,491	238,340
1990	76,732	124,756	5,658	7,582	8,630	7,262	2,058	232,678
1991	80,805	102,478	5,476	6,666	8,368	6,942	2,902	213,637
1992	83,427	92,328	4,940	5,579	8,105	6,834	2,542	203,755
1993	85,872	82,756	4,489	4,571	8,838	6,811	2,801	196,138
1994	86,287	74,294	4,581	4,223	9,345	6,819	2,001	187,550
1995	86,048	76,685	4,589	3,997	9,592	6,804	2,567	190,282
1996	76,735	74,872	4,536	4,250	10,390	6,915	1,799	179,497
1997	76,217	83,515	4,157	3,733	11,248	6,912	2,305	188,087
1998	68,506	81,976	5,797	4,524	13,583	6,878	1,921	183,185
1999	73,483	88,137	5,426	5,697	16,108	6,885	1,566	197,302
2000	75,676	90,323	5,097	12,848	20,226	6,914	1,287	212,371
2001	72,605	84,803	4,858	13,580	22,839	5,499	1,252	205,436
2002	76,849	82,282	5,295	14,598	30,788	7,012	1,424	218,248

Although **Table 4.5** shows a 3.0 percent decrease in non-local single engine piston operations, when this is combined with the 5.9 percent increase in local activity, there was a 1.1 percent increase in total estimated SEP activity. Therefore, **Table 4.5** shows that the 6.2 percent increase in aircraft activity was a result of increases in all aircraft categories.

The largest single impact on the increase in activity was generated by the 34.8 percent increase in jet operations. It has been traditionally accepted that fluctuations in business jet operations are directly related to the economic health of the area. With the softening economy in 2001 and 2002, a decrease in business jet use might have been expected; and in fact, there was a one percent decrease in this activity between January and August 2001. This trend was altered by the September 11, 2001 events.

Between October and December 2001 business jet operations increased 50.7 percent as compared to October through December 2000, and they increased 50.4 percent between January and September 2002 as compared to those same months in 2001. After September 11 many businesses expanded the number of employees eligible to use their company jets and other businesses decided to use private jets rather than commercial airlines. The level of jet activity is particularly relevant because jets dominate the noise exposure.

Table 4.5 also shows that turboprop and twin piston operations increased in 2002 as compared to 2001, 7.5 percent and 9.0 percent respectively. Turboprops represent 6.7 percent of the total operations and twin pistons represent 2.4 percent of Hanscom Field's activity. Helicopter operations, which represent 3.2 percent of the operations, increased 27.5 percent. This increase partially reflects the significant decrease in helicopter operations between September 11, 2001 and November 28, 2001 when VRF activity was restricted.

The turboprop activity was partially influenced by commuter airline activity. Shuttle America continued its service, generating 6,375 operations as compared to 6,414 in 2001. This slight decline was counteracted by the initiation of service by Boston-Maine Airways in July 2002. In the second half of the year Boston-Maine added 228 operations to Shuttle America's 6,375 for a total of 6,603 operations in 2002. This was 3.0 percent greater than the 2001 commuter operations. The two airlines carried 67,688 passengers, a 50 percent decline as compared to 2001. Shuttle America began using a smaller turboprop in 2002 as compared to 2001. Commuter operations represent three percent of the total aircraft activity at the airport.

Over 35 percent of the 2002 activity consisted of touch-and-goes (local). It is estimated that single engine pistons that were not conducting touch-and-goes conducted an additional 37.7 percent of the activity. This indicates that almost 73 percent of the operations were by single engine piston aircraft.

Military activity in 2002, which accounted for less than one percent of the operations, increased almost 14 percent as compared to 2001. The June 2002 air show influenced this increase.

CHAPTER 5 11 P.M. to 7 A.M. OPERATIONS

Hanscom Field is a public facility and is open for use 24 hours a day, although the FAA control tower is closed from 11 p.m. to 7 a.m. Since aircraft using the airport during these hours

communicate with Boston approach, the Bedford tower does not have flight strips, and this activity is not included in the tower counts.

In the summer of 1980, an 11 p.m. to 7 a.m. field use fee was instituted to help reduce noise exposure by encouraging use of the field before 11 p.m. or after 7 a.m. The fee is based on aircraft weight and doubles for aircraft that conduct more than five night operations in a calendar year. From 1980 until 1989 the fees were $20 for aircraft weighing 12,500 pounds or less and $150 for aircraft weighing more than 12,500 pounds.

In 1988 there was a review of the nighttime field use fee, and in 1989, the Massport Board voted to increase the fees to reflect the Consumer Price Index (CPI) increase between 1980 and 1989 and to institute an annual CPI increase, effective each July 1. The fees were $43 and $315 for the first six months of 2002. They were $44 and $320 for the second half of the year.

Records for activity between 11 p.m. and 7 a.m. were not maintained prior to the institution of the night field use fee. **Table 5.1** shows the history of these operations starting with 1981, the first full year they were logged. There were fluctuations in the early 1980s and then increases until 1989. In 1990, nighttime activity decreased and subsequently remained below 1,000 annual operations through 1995. This was a likely reflection of the depressed economy and the increase in the fees. Since 1996 the number of night operations has consistently exceeded 1,000, partially due to night activity by the medical evacuation helicopter that transports critically ill or injured patients. This helicopter service moved to Hanscom in October 1995 and now conducts over 500 night operations annually. Night operations increased almost 30 percent from 1,674 in 2001 to 2,170 in 2002.

TABLE 5.1 11 p.m. to 7 a.m. Operations Since Nighttime Fee was Instituted

Year	11 p.m.-7 a.m.	Year	11 p.m.-7 a.m.
1981	585	1992	702
1982	532	1993	689
1983	640	1994	735
1984	759	1995	919
1985	442	1996	1159
1986	466	1997	1495
1987	850	1998	1390
1988	1098	1999	1622
1989	1053	2000	1918
1990	773	2001	1674
1991	797	2002	2170

NOTE: The totals include those aircraft operations that are exempt from the fee, with the exception of some missing exemption figures from 1983 and 1984 and possibly from 1981 and 1982. Since exemptions in the 1980s represented a small number of nighttime operations, the totals in the table are assumed to closely reflect the number of night operations for each year.

The data in **Table 5.1** are plotted in **Figure 5.1,** illustrating the fluctuations in 11 p.m. to 7 a.m. activity. It demonstrates that 1988, 1989, and 1996 through 2002 are the eight years when there were more than 1,000 nighttime operations, and 2002 was the only year that exceeded 2,000 operations.

FIGURE 5.1 Annual 11 p.m. to 7 a.m. Operations Since Nighttime Fee was Instituted

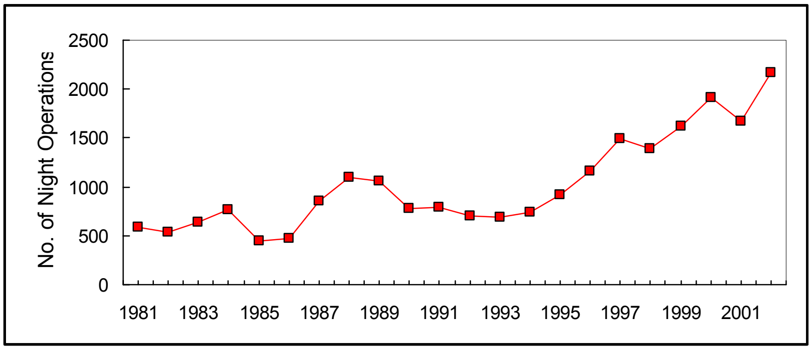


Table 5.2 provides an overview of the 2002 11 p.m. to 7 a.m. operations by aircraft type, arrivals and departures, and significant flight times. It also shows a breakdown of the number of operations by fee amount levied for each type of aircraft. The fee column headings show two dollar-amounts. The lesser amount was charged from January through June and the greater amount was charged after the July 1 CPI adjustment. Those aircraft being charged $86/$88 or $630/$640 conducted more than five operations in the calendar year.

TABLE 5.2 Breakdown of 2002 11 p.m. to 7 a.m. Operations

TYPE			TIME OF OPERATION			FEE DISTRIBUTION					TOTAL
	Arr.	Dep.	11PM to 12 AM	6 to 7 AM	Other	$43/ $44	$86/ $88	$315/ $320	$630/ $640	Exempt	
Jets	671	408	282	251	546	24	8	856	154	37	1079
Singles	109	33	62	22	58	114	1	0	0	27	142
Twins	57	47	20	18	66	70	20	0	0	14	104
Turbos	176	97	103	68	102	110	7	94	32	30	273
Helis	281	291	116	25	431	29	16	0	0	527	572
TOTAL	1294	876	583	384	1203	347	52	950	186	635	2170

Of the 2,170 night operations, 635 were exempt. Almost 89 percent of the exemptions were medical flights, which were dominated by the medical evacuation service based at Hanscom. Exemptions also included military, Federal Aviation Administration, and Civil Air Patrol operations, as well as Hanscom aircraft that used the airport between 11 p.m. and 7 a.m. due to unavoidable circumstances, such as weather, mechanical, or FAA delays. There were 769 different civilian aircraft that were subject to the nighttime fee. Of those, 39 conducted more than five non-exempt nighttime operations.

Sixty percent of the 11 p.m. to 7 a.m. operations were arrivals, and 40 percent were departures. Almost 18 percent of these operations occurred between 6 a.m. and 7 a.m. while 27 percent were between 11 p.m. and midnight. The remaining 55 percent were between midnight and 6 a.m.

Jets conducted the largest number of night operations by a single group, representing almost 50 percent of the activity. Helicopters represented 26 percent, turboprops 13 percent, single engine pistons seven percent, and twin engine pistons five percent of the night activity.

CHAPTER 6 NOISE EXPOSURE LEVELS

As discussed in Chapter 2, the 1982 HMMH noise study defined a screening metric, referred to as EXP, to use in evaluating changes in noise exposure without resorting to complex noise exposure contours for each application. It is the logarithmic sum, in decibels (dBA), of the aircraft noise on an average day for the aircraft that used Hanscom. The estimate is made at a point on the ground representing some of the airport's closest residential neighborhoods (15,000 feet from brake release for departures). A "noise penalty" of 10 dB is applied to operations between 10 p.m. and 7 a.m. to account for their greater intrusive quality.

6.1 2002 EXP Version 6.0c (EXP 6.0c)

Noise exposure, represented by the EXP metric, is calculated monthly and annually. **Table 6.1** presents the monthly departure EXP 6.0c values, including the effects of SEP aircraft, for 2002. Those portions of the noise attributable to civilian and military aircraft are separated in the table to show the relative contributions of each. The distinction is important because military aircraft are exempt from the noise abatement measures that are applicable to civilian aircraft, and so they have some of the highest SEL values as compared to the other aircraft that use the airport. Although military aircraft represented less than one percent of the activity in 2002, they contributed 19 percent of the total noise energy.

TABLE 6.1 Monthly Variations in Departure EXP 6.0c for 2002

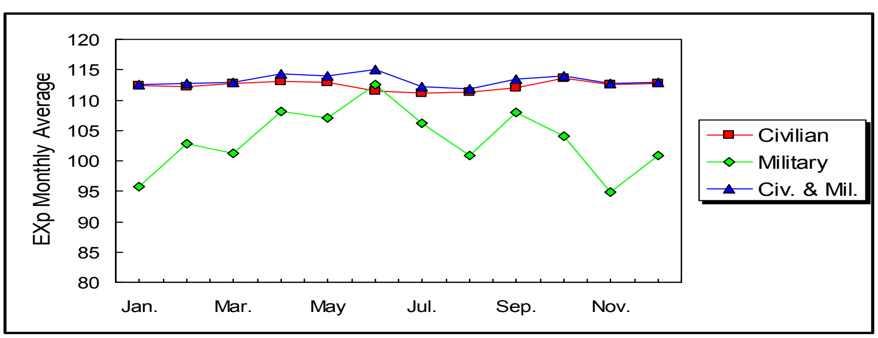
Month	EXP 6.0c with SEP AIRCRAFT		
	Civilian	Military	Civilian & Military
Jan.	112.4	95.7	112.5
Feb.	112.3	102.8	112.7
Mar.	112.7	101.3	113.0
Apr.	113.1	108.2	114.3
May	112.9	107.1	113.9
Jun.	111.5	112.6	115.1
Jul.	111.1	106.2	112.3
Aug.	111.4	100.9	111.8
Sep.	112.0	107.9	113.5
Oct.	113.6	104.1	114.0
Nov.	112.6	94.9	112.7
Dec.	112.7	100.9	113.0
2002	112.4	106.1	113.3

Civilian departure EXP 6.0c for 2002 was 112.4 dB and fluctuated between a low of 111.1 dB in July to a high of 113.6 dB in October. These do not correlate with the highs and lows for civilian non-SEP activity levels shown in **Table 4.2** because EXP factors in the fleet mix and the time of the operations, not just the number of operations. Military EXP totaled 106.1 dB and ranged from a high of 112.6 dB in June, when Hanscom Air Force Base hosted its air show, to a low of 94.9 dB in November.

The highest total EXP during the year was reached in June when the civilian portion combined with the military portion to total 115.1 dB. This is the only month that military EXP exceeded the civilian portion, which is a reflection of the air show activity. August experienced the lowest total noise exposure, 111.8 dB, with the civilian portion at its second lowest level and military EXP at its third lowest level for the year.

The data from **Table 6.1** are plotted in **Figure 6.1.** **Figure 6.1** demonstrates that military noise levels had greater monthly variation than the civilian portions**.** **Figure 6.1** also shows that civilian aircraft were the dominant noise source in 2002, except in June.

FIGURE 6.1 2002 Monthly Averages in Departure Noise Exposure; EXP 6.0c



Appendix B shows a detailed table of 2002 EXP 6.0c. It includes the average daily departures and arrivals and the departure and arrival SELs for each civilian and military aircraft group. The aircraft types listed for each group are representative of those included in the group, and the partial EXP specifies the noise impact for that group of aircraft. As explained in Chapter 2, changes in departure EXP more closely reflect changes in Ldn than do changes in arrival EXP, so this report focuses on civilian departure EXP for primary comparative purposes. However, arrival EXP is being calculated and is included in Appendix B.

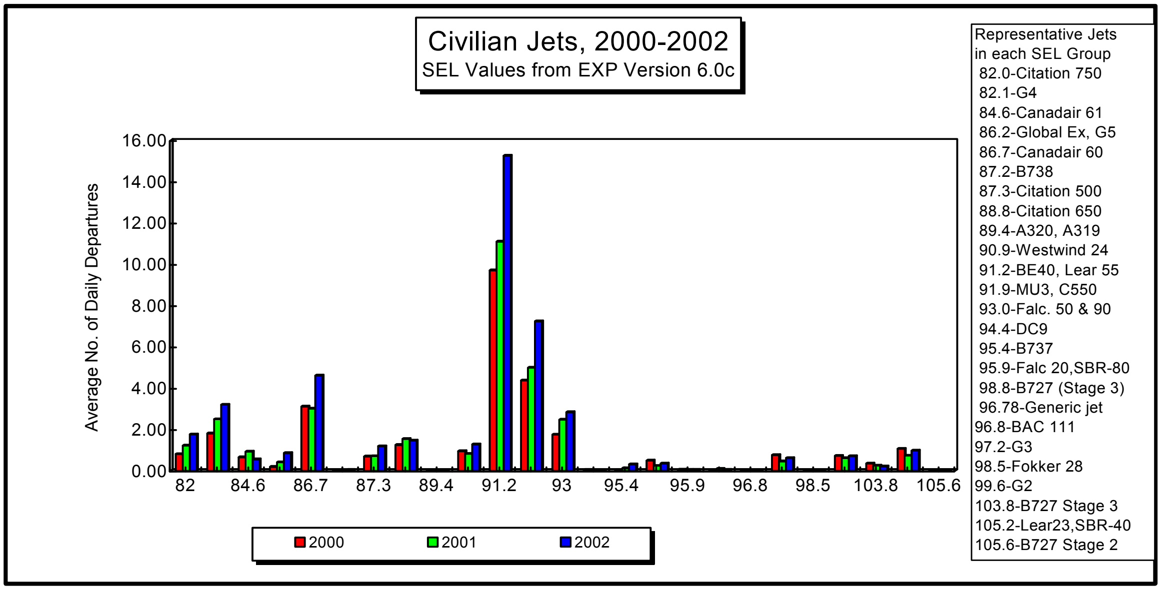
EXP 6.0c results show that in 2002, civilian aircraft generated approximately 81 percent of the total departure noise energy at Hanscom Field. **Table 6.2** presents the contribution to the 2002 civilian departure EXP by several aircraft categories, illustrating the effect of civilian jets. Although civilian jets comprised only 14 percent of the civilian operations, they had the highest partial EXP, and consequently represented over 87 percent of the civilian noise energy. This is due to the relatively high SEL values assigned to them. Single engine piston aircraft contributed 8.5 percent of the noise energy. They have a relatively low SEL but have the second highest partial EXP because of the large number of operations by these aircraft, which comprise almost 73 percent of the civilian activity.

TABLE 6.2 Contribution to Civilian Departure EXP for 2002 Operations

Aircraft Category	Partial EXP 6.0c Contribution to Civilian Departure Noise Exposure
Jets	111.8
Turboprops	92.6
Helicopters	95.8
Twin Engine Pistons	92.8
Single Engine Pistons	101.7
TOTAL CIVILIAN EXP	112.4

Since civilian departure EXP is heavily dominated by jet activity, it is useful to look at the number of operations conducted at Hanscom Field by the jets in each SEL group, and to see how they compare to previous years. Using data from Appendix B and comparable data for 2000 and 2001, **Figure 6.2** demonstrates that, as compared to 2001, 2002 experienced increases of less than one average daily departure in 12 of the civilian jet noise groups; there were decreases of less than one daily departure in five of the groups; and five groups remained stable. The three groups that had increases of more than one average daily departure had departure SELs of less than 91.9 dB. There was an increase of less than one average daily departure in one group whose SEL exceeds 100 dB.

FIGURE 6.2 Average Daily Jet Departures by SEL Groups, 2000-2002



6.2 EXP Comparisons for Study Years, 1978-2002

EXP 6.0c was used in the ESPR for the year 2000, and has been applied to the years 2001-2002 for this report. **Table 6.3** shows the results of these analyses.

TABLE 6.3 EXP 6.0c Annual Comparisons, 2000-2002

		DEPARTURE EXP	ARRIVAL EXP
CIVILIAN COMPONENT, WITH SINGLES			
	2000	112.3	109.1
	2001	111.6	108.6
	2002	112.4	109.5
MILITARY COMPONENT			
	2000	103.6	99.0
	2001	104.1	99.4
	2002	106.1	97.3
TOTAL EXP (INCLUDING MILITARY AND SINGLES)			
	2000	112.8	109.5
	2001	112.3	109.1
	2002	113.3	109.8

The other study years are not included in **Table 6.3** because different versions of EXP were used to calculate noise exposure for those years. However, the importance of EXP is not in its specific value but rather in the change in EXP from one year to the next. **Table 6.4,** which shows civilian departure EXP for the study years from 1978 through 2001, helps illustrate how changes in EXP have been demonstrated in previous annual noise reports, despite the use of different EXP versions. The 1978 and 1987 EXP using Noisemap for civilian aircraft departures was 112.5 dB. The resulting zero in the "Difference" column indicates equal civilian departure noise exposure, and this equal noise exposure allowed 1987 to serve as an alternate base year. EXP Version 3.9 for 1987 civilian departures was 112.0 dB. From 1988 to 1995, EXP 3.9 results were calculated and the difference from 1987 indicated the year-to-year difference from the base year.

TABLE 6.4 Civilian Departure EXP Comparisons, 1978-2001

		Annual EXP	Base Year EXP	Difference from Base Year
Noisemap	**1978**	**112.5**	**Original Base Year**	
	1981	**111.3**	112.5	-1.2
	1983	**111.8**	112.5	-0.7
	1984	**112.2**	112.5	-0.3
	1985	**111.9**	112.5	-0.6
	1986	**111.8**	112.5	-0.7
	1987	**112.5**	**112.5**	0.0
Version 3.9	**1987**	**112.0**	**Alternate Base Year**	
	1988	**112.4**	112.0	0.4
	1989	**111.6**	112.0	-0.4
	1990	**110.8**	112.0	-1.2
	1991	**110.7**	112.0	-1.3
	1992	**111.4**	112.0	-0.6
	1993	**110.6**	112.0	-1.4
	1994	**111.4**	112.0	-0.6
	1995	**111.6**	112.0	-0.4
Version 5.1	**1987**	**112.1**	**Alternate Base Year**	
	1996	**112.0**	112.1	-0.1
	1997	**112.3**	112.1	0.2
	1998	**113.1**	112.1	1.0
	1999	**113.0**	112.1	0.9
	2000	**113.4**	112.1	1.3
	2001	**112.5**	112.1	0.4

The 1996 transition to EXP 5.1 was not facilitated by equal noise exposure to 1987, so 1987 was recalculated using EXP 5.1. **Table 6.4** shows the civilian departure EXP 5.1 for 1987 is 112.1 dB, which was used for comparative purposes between 1996 and 2001.

Past methodologies are not practical for the transition to EXP 6.0c. Neither 2000 nor 2001 EXP 5.1 equals 1987, and there is a risk in assuming that 15 year old data can be manipulated using SELs developed for 2000 flying procedures and aircraft. Instead, EXP 5.1 and 6.0c have been applied to the data for 2000 and 2001 to provide a two year overlap. Although, this does not allow for a direct comparison of current EXP to study years prior to 2000, EXP 5.1 can illustrate the changes from 1978 to 2000; both EXP 5.1 and EXP 6.0c can illustrate the changes from 2000 to 2001, and EXP 6.0c can illustrate future changes. This allows for a continued understanding of how EXP is changing over time.

Table 6.5 shows EXP 5.1 and 6.0c for the years 2000 and 2001, EXP 6.0c for 2002, and the changes in EXP as compared to the previous year and to 2000.

TABLE 6.5 Civilian Departure EXP Comparisons, 2000-2002

		Annual EXP	Difference from 2000	Difference from 2001
Version 5.1	**2000**	**113.4**		
	2001	112.5	-0.9	n/a
Version 6.0c	**2000**	**112.3**		
	2001	111.6	-0.7	n/a
	2002	112.4	0.1	0.8

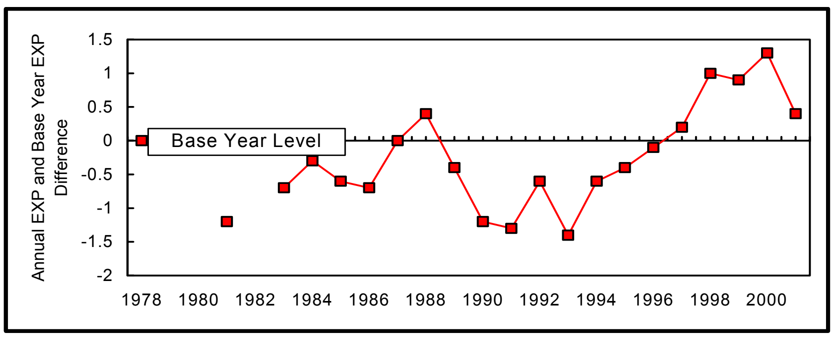
Table 6.5 illustrates the difference that results when using EXP 5.1 and EXP 6.0c for a year-to-year comparison. EXP 5.1 shows a decrease of 0.9 dB between 2000 and 2001, while EXP 6.0c shows a decrease of 0.7 dB. The 0.2 dB difference is caused by changes in SELs for some aircraft, most notably a reduction for the older model Gulfstreams.

The data in **Tables 6.4 and 6.5** can be used to indicate the change in EXP between 1978 and 2002, despite the use of different versions of EXP. **Table 6.4** shows a 1.3 dB increase in noise exposure between 1978 and 2000, and **Table 6.5** shows an increase of 0.1 dB between 2000 and 2002. Adding these increases together indicates an increase of 1.4 dB between 1978 and 2002. At the same time, **Table 6.4** shows a 0.4 dB increase in noise exposure between 1987 and 2001, and **Table 6.5** shows an increase of 0.8 dB between 2001 and 2002. Adding these two increases together indicates an increase of 1.2 dB. These comparisons indicate that EXP for 2002 is 1.2 to 1.4 dB above 1978.

6.3 Analysis of Changes in Annual EXP for Study Years, 1978-2002

The EXP differences for the study years 1978 through 2001 shown in **Table 6.4** are plotted in **Figure 6.3** to demonstrate the way EXP has changed for each study year between 1978 and 2001. **Figure 6.3** illustrates a decrease in civilian departure EXP between 1978 and 1981, a subsequent general upward trend through 1988, a decline in the early 1990s and a consistent increase from 1993 through 1998. From 1998 to 2001, EXP has fluctuated at levels above the 1978 base year. **Figure 6.3** also demonstrates that, prior to 2002, 2000 is the study year with the highest civilian departure EXP and that the 1993 level was the lowest of all the study years.

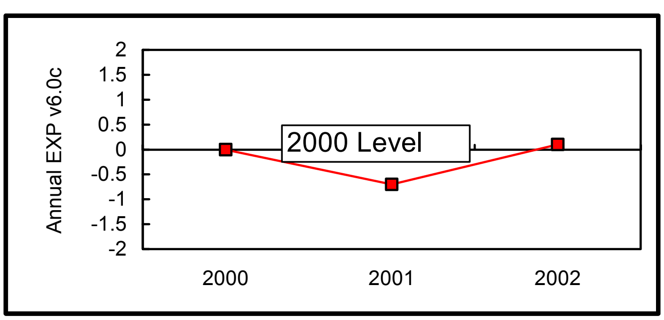
FIGURE 6.3 Differences Between Civilian Departure EXP for Study Years, 1978-2001



Note: 1979, 1980 and 1982 data unavailable

The EXP 6.0c differences for 2000 through 2002, shown in **Table 6.5**, are plotted in **Figure 6.4** to provide a visual picture of the way EXP has changed in the last two years. As in **Figure 6.3, Figure 6.4** illustrates the decrease in EXP between 2000 and 2001, and it also shows the subsequent increase in 2002. This indicates that 2002 had a higher EXP than the previous 2000 high for all the study years.

FIGURE 6.4 Comparisons of Civilian Departure EXP 6.0c for Study Years, 2000-2002



The fluctuations in civilian EXP over the past 24 years demonstrate three major influences on noise exposure: the number of jet operations, since they dominate the noise exposure, as discussed in Section 6.1; whether the jet operations operate between 10:00 p.m. and 7:00 a.m. when the "noise penalty" is applied; and the amount of noise energy generated by each jet.

The noise energy levels of the Hanscom fleet have been influenced by federal and Massport regulations. The FAA first issued noise standards for civil aircraft in 1969, when regulations established that minimum noise performance levels be demonstrated for new turbojet and transport category large airplane designs. In 1977, more stringent standards were adopted, and Stage 1, 2, and 3 classifications were introduced. Stage 1 airplanes do not meet either the 1969 or 1977 standards. Stage 2 airplanes meet the 1969 standards but do not meet the 1977 standards. Stage 3 airplanes meet the 1977 standards.

In 1980, Massport adopted rules to address some of the noise issues being discussed with the aviation and residential communities. The impact of these is discussed in depth in the 1982 HMMH noise report (available in Massport offices). These rules phased out most Stage 1 civilian jet operations and established a fee to discourage nighttime activity. With these rules in place, 1981 civilian departure EXP decreased 1.2 dB as compared to 1978, the only previous study year. This initial decrease was followed by an upward trend in civilian departure EXP caused by an overall increase in jet activity resulting from a strong economy. By 1987, the noise exposure equaled 1978, and the 1988 exposure exceeded the base year for the first time.

Between 1988 and 1993, there was an overall decrease in civilian departure EXP. Initially the primary influence was a decline in business jet operations, including fewer Stage 2 jets. In 1993, when civilian departure EXP dropped to the lowest level of all the study years, there were increases in business jet activity but Stage 2 jet operations decreased.

From 1993 through 2000, EXP shows an upward trend for civilian departures caused by annual increases in business jet operations. In most years that included more Stage 2 jet activity and more jet activity between 10:00 p.m. and 7:00 a.m.

In 2001, civilian departure EXP decreased, despite increases in jet activity. The decrease reflected a decline in 10 p.m. to 7 a.m. operations, which are weighted for their more intrusive nature, and a decrease in Stage 2 operations both during the day and nighttime hours. In 2002, there were increases in both Stage 2 and Stage 3 jet activity, and this occurred between 7 a.m. and 10 p.m. as well as between 10 p.m. and 7 a.m.

The primary influence on jet activity levels is the economy. With the positive economic trends of the mid to late 80s and again in the mid to late 90s and into 2000, business jet activity increased at Hanscom Field. In addition, the events of September 11, 2001 resulted in a surge in business jet operations despite the slow economy at the time. Helping counteract the increases in jet operations in the 1980s was the phase out of most Stage 1 jets at Hanscom Field, and in the 1990s there was some turnover from Stage 2 to Stage 3 jets as businesses upgraded their equipment. The latter was influenced by the national requirement that jets over 75,000 pounds

meet Stage 3 certification levels by the year 2000, although most jets that use Hanscom weigh less than 75,000 pounds.

Of particular importance in the near future will be whether the turnover to Stage 3 aircraft will be significant enough to counteract any increases in business jet activity that may occur. It is worth noting that in 1995, 18 percent of the jet operations were conducted with Stage 2 aircraft. In 2000, this had dropped to 11 percent, and in 2002 they represented six percent. There is no mandatory phase out of these aircraft that weigh under 75,000 pounds, but it is reasonable to assume that they will eventually become obsolete. Furthermore, it is unclear whether the surge seen in the use of business jets after September 11, 2001 will be maintained or whether it will subside, with at least some business travelers returning to commercial airlines.

CHAPTER 7 NOISE MONITORING SYSTEM

In the late 1980s, Massport and the surrounding communities agreed that a permanent noise monitoring system could add valuable data to the existing method of calculating the annual EXP, providing a more complete picture of the noise environment at the airport. In the early 1990s, five noise monitors were installed on and around Hanscom Field. A sixth monitor was installed in late 1994. Data for all of the sites are available starting in 1995.

Table 7.1 shows the readings at the six sites for 1995 through 2002. Appendix C shows the readings for the sites, by month and year for 1999 through 2002. It also includes a map showing the locations for the monitors. The data shown are Day Night Noise Levels (Ldn) in A-weighted decibels, both of which are described in Appendix A. These are actual measured levels, so they include military and civilian aircraft as well as community noise.

TABLE 7.1 Measured Ldn Levels--1995 Through 2002

Site Number	1995	1996	1997	1998	1999	2000	2001	2002
31	67.2	65.8	66.7	65.4	67.3	66.5	66.0	67.3
32	66.7	64.3	65.0	66.6	63.8	64.5	64.6	65.5
33	57.1	56.5	57.8	58.0	56.2	55.7	55.6	56.6
34	60.1	60.9	61.7	60.7	59.6	59.7	60.5	61.2
35	60.5	60.1	61.1	60.6	60.0	60.2	59.8	60.4
36	62.4	62.5	62.2	62.5	63.1	62.8	62.1	61.4

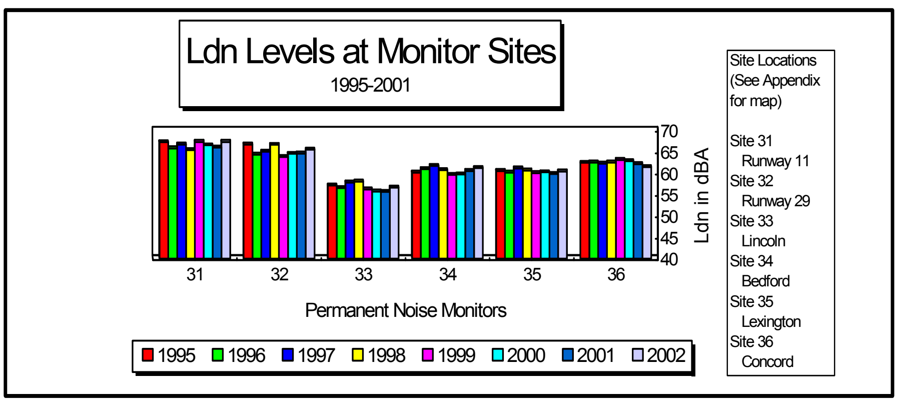
A comparison of the annual Ldn values for 2001 and 2002 shows increases of one decibel or less at four of the six sites. Site 31, located at the Runway 11 approach, increased 1.3 dB. Site 36, in Concord, decreased 0.7 dB. The measured changes must be looked at carefully for both aviation and non-aviation influences.

In June of 1995, June of 1997, August of 1998, and June of 2002 there were Air Force Air Shows that generated high noise levels. Also, in October of 1995 and August 1998 there was a test of navigational equipment, which required a military KC135 (Boeing 707 equivalent) to conduct multiple low approaches over the airport. These military events are known to have contributed to the readings in those years but are only partially reflected in military EXP because only the IFR events are entered into the calculations. Readings may also reflect community events near the sites. For example, Site 36 is located near the Concord wastewater treatment plant, which produces background noises that contribute to the readings. As a result, Site 36 consistently shows the highest recorded levels at an off-airport site.

Sites 31 and 32 consistently have the highest readings, since they are located on the airport at the ends of Runway 11/29. They are the least likely to be influenced by community noise and therefore have the closest correlation to modeled noise.

The data in **Table 7.1** are plotted in **Figure 7.1**, which demonstrates the fluctuations in measured noise at the six sites over the past eight years.

FIGURE 7.1 Measured Ldn Values--1995 Through 2002



CHAPTER 8 NOISE ABATEMENT POLICIES

Massport strives to find the balance between operating a safe and secure, high quality, viable airport and being sensitive to the concerns of the surrounding communities. This is a difficult task since many residents would prefer aircraft did not fly over their homes, but operating an airport inherently means that aircraft will be using the field.

In 1978, the Massport Board adopted the *Hanscom Field Master Plan and Environmental Impact Statement* (The Master Plan). This included a series of policies that were developed by Massport staff in conjunction with the Governor's Hanscom Field Task Force and members of the public.

The plan's 12 policy statements fell under four broad categories, as follows:

Growth:
1. The character of the airport
2. Airport activity and runway facilities
3. Certified passenger air carrier operations
4. Passenger commuter operations
5. Cargo operations
6. Airport improvements
7. Aircraft noise

Land use:
1. Aviation related land use
2. Other Massport properties

Ground access:
1. Ground access

Planning process:
1. Hanscom Field Advisory Committee
2. Airport System Planning

One outgrowth of The Master Plan was the formation of the HFAC. Another was the adoption of the 1980 Rules designed to address noise issues. The rules included the phase out of some of the most noisy planes that were using the field, limiting touch-and-go operations to aircraft under 12,500 pounds, limiting touch-and-go activity to the hours of 7 a.m. to 11 p.m., and the development of the nighttime field use fee, as discussed in Chapter 5. It also provided parameters for the use of Ground Power Units and updated the definition of commuter aircraft that had been referenced in The Master Plan.

The Master Plan and the 1980 Rules (available in Massport offices) continue to guide Massport for Hanscom related decisions. Massport continues its diligent enforcement of the rules, such as collection of the nighttime field use fee, as well as actively sharing data, plans and positions with the aviation and residential communities. Massport staff participate at all Hanscom Field Advisory Commission meetings and attend Hanscom Area Towns Committee (HATS) meetings, as well as other forums where their presence is requested or seems warranted.

In 1997, Massport completed a Generic Environmental Impact Report (GEIR) Update to reflect changes in environmental effects since the first GEIR was completed in 1988. The Secretary of Environmental Affairs found the update to adequately comply with the Massachusetts

Environmental Policy Act (MEPA) and the Scope that had been issued for the study. The GEIR Update includes an analysis of 1995 noise levels. In 2002, Massport completed the Environmental Status and Planning Report (ESPR), a further update of the environmental effects of Hanscom Field. This was also found to adequately comply with MEPA. The ESPR includes a comprehensive analysis of 2000 noise levels and looks at potential future noise levels based on a series of future scenarios. All of these reports are available for review in the Massport offices and the libraries of the four contiguous towns.

In 1998 and 2000, Massport staff worked closely with the Noise Working Group, an outgrowth of the GEIR Update. The group, which included aviation and residential community members, formed two subgroups, one to develop noise abatement and mitigation recommendations and the other to review and recommend metrics to be used to describe the Hanscom Field noise environment. The recommendations were submitted to Massport in late 2000. In 2001, Massport began taking steps to incorporate many of the recommendations. This included developing an on-going program for encouraging pilots to use noise abatement procedures.

Massport's operation of Hanscom Field continues to reflect its responsibility to the regional aviation system and to the business community. At the same time, Massport recognizes the noise impacts and strives to work with the surrounding communities to help them understand the importance of the airport as a resource while finding mutually acceptable mechanisms to minimize the issues that are of concern.

APPENDIX A

Noise Terminology Used

at

Hanscom Field (1) and Ldn Noise Contour Maps

(1) Excerpt from: 2000 L.G. Hanscom Field Environmental Status and Planning Report

Noise Terminology

Noise, often defined as unwanted sound, is one of the most common environmental issues associated with aircraft operations. Aircraft are not the only sources of noise in an urban or suburban environment where interstate and local roadway traffic, rail, industrial, and neighborhood sources also intrude on the everyday quality of life. Nevertheless, aircraft are readily identified by their noise and are typically singled out for special attention and criticism. Consequently, aircraft noise problems often dominate analyses of environmental impacts. To help understand and interpret these impacts, it is important to be familiar with the various metrics that are used to describe the noise from an aircraft and from the collection of noise events that comprise an airport noise environment. This introductory section describes those commonly used noise metrics, in increasing complexity. They include the:

- Decibel (dB)
- A-weighted decibel, or sound level (dBA)
- Sound Exposure Level (SEL)
- Equivalent Sound Level (L_{eq})
- Day-Night Sound Level (DNL)
- Time Above (TA)

The Decibel, dB

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air, and are sensed by the human ear. Whether that sound is interpreted as pleasant (music, for example) or unpleasant (aircraft noise, for example) depends largely on the listener's current activity, experience, and attitude toward the source of that sound. It is often true that one person's music is another person's noise.

The loudest sounds the human ear can comfortably hear have one trillion (1,000,000,000,000) times the acoustic energy of sounds the ear can barely detect. Because of this vast range, any attempt to represent the intensity of sound using a linear scale becomes unwieldy. As a result, a logarithmic unit called the decibel (dB) is used to represent the intensity of sound. This representation is called a sound pressure level.

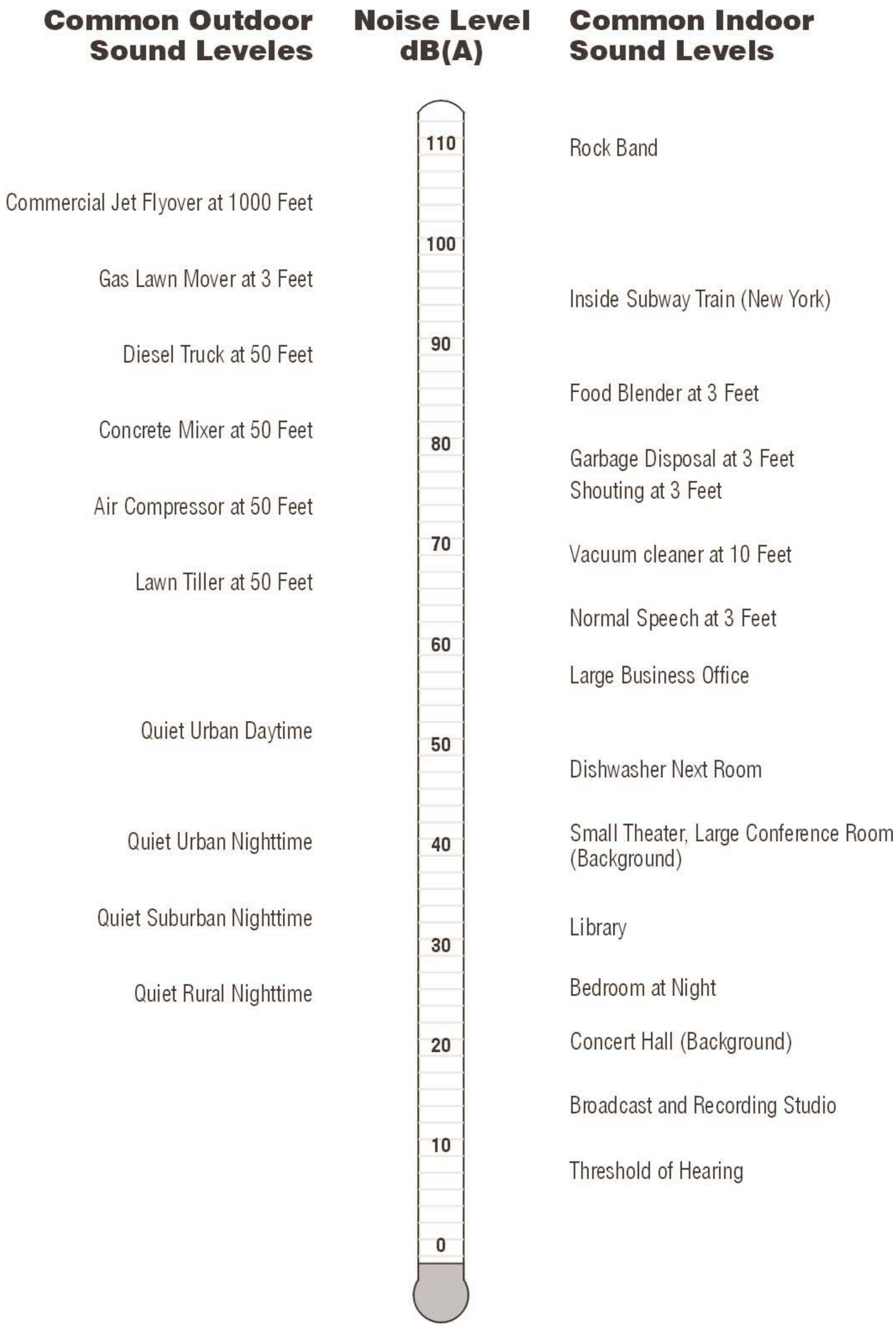
A sound pressure level of less than 10 dB is approximately the threshold of human hearing and is barely audible under extremely quiet conditions. Normal conversational speech has a sound pressure level of approximately 60 to 65 dB. Sound pressure levels above 120 dB begin to be felt inside the human ear as discomfort and eventually pain at still higher levels.

A-weighted Sound Level, dBA

Additionally, not all sound pressures are heard equally well by the human ear. Some tones are easier to detect than others and are perceived as being louder or noisier. Thus, in measuring community noise, frequency dependence is taken into account by adjusting the very high and very low frequencies to approximate the human ear's reduced sensitivity to those frequencies. This adjustment is called "A-weighting" and is commonly used in measurements of environmental noise.

Figure 7-1 shows A-weighted sound levels for some common sounds. In this document, all sound pressure levels are A-weighted and, as is customary, are referred to simply as "sound levels," where the adjective "A-

Figure 7-1 Common A-weighted Sound Levels

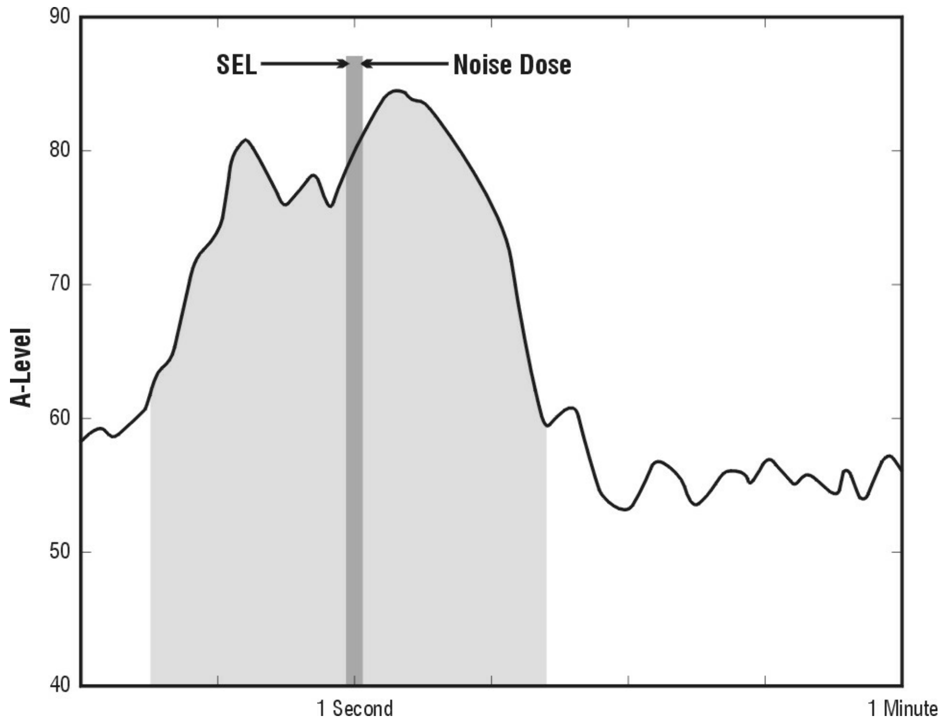


weighted" has been omitted. Sound levels are designated in terms of A-weighted decibels, abbreviated dBA. With A-weighting, a noise source having a higher sound level than another is generally perceived as louder. Also, the minimum change in sound level that people can detect outside of a laboratory environment is on the order of 3 dB. A change in sound level of 10 dB is usually perceived by the average person as a doubling (or halving) of the sound's loudness, and this relationship holds true for loud sounds as well as for quieter sounds.

Sound Exposure Level, SEL

A further complexity in judging the impact of a sound is how long it lasts. Long duration noises are more annoying than short ones. The period over which a noise is heard is accounted for in noise measurements and analyses by integrating sound pressures over time. In the case of an individual aircraft flyover, this can be thought of as accounting for the increasing noise of the airplane as it approaches, reaches a maximum, and then falls away to blend into the background (see Figure 7-2). The total noise dose, or exposure, resulting from the time-varying sound is normalized to a one-second duration so that exposures of different durations can be compared on an equal basis. This time-integrated level is known as the Sound Exposure Level (SEL), measured in A-weighted decibels.

Figure 7-2 Illustration of Sound Exposure Level



Because aircraft noise events last longer than one second, the time-integrated SEL always has a value greater in magnitude than the maximum sound level of the event – usually about 7 to 10 dB higher for most airport environments. SELs are used in this study as a means of comparing the noise of several significant aircraft types; they are also highly correlated with sleep disturbance, an impact that is discussed in Appendix G.

The remaining noise metrics discussed in this section refer to the accumulation of exposure caused by multiple noise events over time. While such metrics are often viewed as downplaying the importance of individual aircraft operations, they are extremely good indicators of community annoyance with complex noise environments, and they have become widely accepted as the most appropriate means of evaluating land use planning decisions.

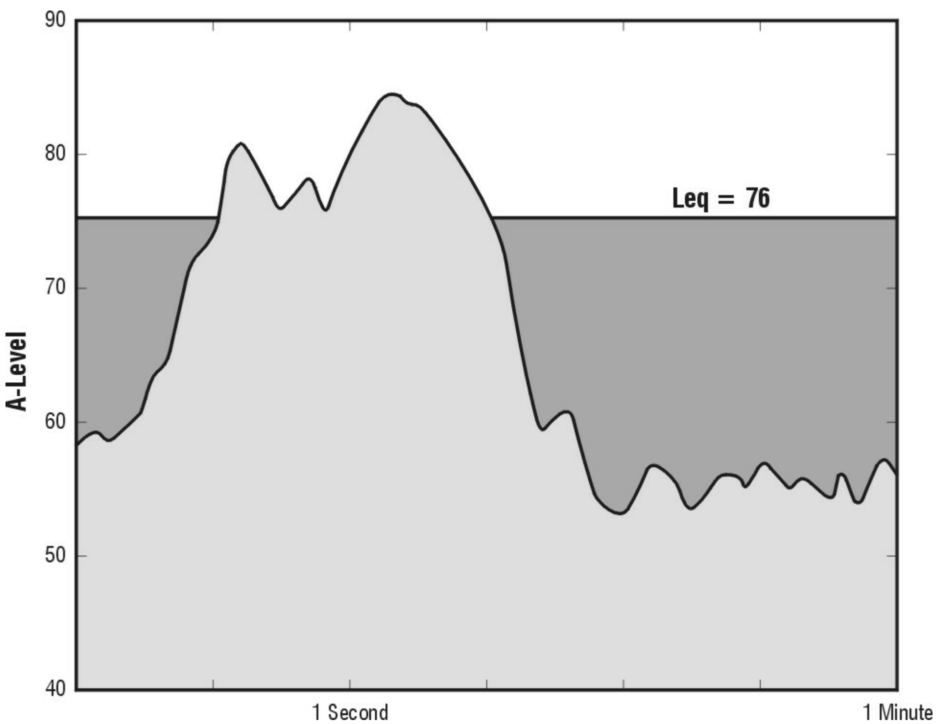
Equivalent Sound Level, L_{eq}

The most basic measure of cumulative exposure is the Equivalent Sound Level (L_{eq}). It is a measure of exposure resulting from the accumulation of A-weighted sound levels over a particular period (as opposed to an event) of interest such as an hour, an eight-hour school day, nighttime, a single 24-hour period, or an

average 24-hour period. Because the length of the period can differ, the applicable period should always be identified or clearly understood when discussing the metric. Such durations are often identified through a subscript, for example $L_{eq}(8)$ or $L_{eq}(24)$.

Conceptually, the L_{eq} may be thought of as the constant sound level occurring over the designated period of interest and having as much sound energy as that created by the actual rising and falling sound pressures from multiple noise sources as they become more or less pronounced. This is illustrated in Figure 7-3 for the same representative one-minute of exposure shown earlier in Figure 7-2. Both the dark and light gray shaded areas have a one-minute L_{eq} value of 76 dBA. It is important to recognize, however, that the two representations of exposure (the constant one and the time-varying one) would sound very different from each other were they to occur in real life.

Figure 7-3 Illustration of Equivalent Sound Level



Often the L_{eq} is referred to misleadingly as an "average" sound level. This is not true in the traditional sense of the term average. Because decibels are logarithmic quantities, loud events dominate the calculation of the L_{eq}. For example, if an aircraft produced a constant sound level of 85 dBA for 30 seconds of a minute then immediately disappear, leaving only ambient noise sources to produce a level of 45 dBA for the remaining 30 seconds, the L_{eq} for the full minute would be 82 dBA – just 3 dBA below the maximum caused by the aircraft, not the 65 dBA suggested by normal averaging. More typical timeframes of interest are daytime, nighttime, and annual average 24-hour exposure levels, but all of these same principles of combining sound levels apply to those periods as well. Loud noise events occurring during any timeframe are going to have the greatest influence on the overall exposure for the period.

The Day-Night Sound Level, DNL

The most widely used cumulative noise metric is a variant of the 24-hour L_{eq} known as the Day-Night Sound Level, or DNL, a measure of noise exposure that is highly correlated with community annoyance. The long-term (yearly) average DNL is also associated with a variety of land use guidelines that suggest

where incompatibilities are expected to exist between the noise environment and various human activities. Because of these strengths, the metric is required to be used on airport noise studies funded by the Federal Aviation Administration (FAA).

In simple terms, DNL is the equivalent sound level for a 24-hour period, modified so that noises occurring at night (defined specifically as 10:00 p.m. to 7:00 a.m.) are artificially increased by 10 dB. This "penalty" reflects the added intrusiveness of nighttime noise events as community activity subsides and ambient noise levels get quieter. The penalty is mathematically equivalent to multiplying the number of nighttime noise events by a factor of ten.

The U.S. Environmental Protection Agency (EPA) identified DNL as the most appropriate means of evaluating airport noise based on the following considerations[1]:

- The measure should be applicable to the evaluation of pervasive long-term noise in various defined areas and under various conditions over long periods of time.
- The measure should correlate well with known effects of the noise environment and on individuals and the public.
- The measure should be simple, practical and accurate. In principal, it should be useful for planning as well as for enforcement or monitoring purposes.
- The required measurement equipment, with standard characteristics, should be commercially available.
- The measure should be closely related to existing methods currently in use.
- The single measure of noise at a given location should be predictable, within an acceptable tolerance, from knowledge of the physical events producing the noise.
- The measure should lend itself to small, simple monitors, which can be left unattended in public areas for long periods of time.

Despite these origins, the lay public often criticizes the use of DNL as not accurately representing community annoyance and land use compatibility with aircraft noise. Much of that criticism stems from a lack of understanding of the measurement or calculation of DNL. One frequent criticism is based on the feeling that people react more to single noise events than to "meaningless" time-average sound levels. In fact, DNL takes into account both the noise levels of all individual events occurring during a 24-hour period and the number of times those events occur. The logarithmic nature of the decibel causes noise levels of the loudest events to control the 24-hour average, just as they were shown to do in the previous discussion of shorter-term L_{eq}s.

Most federal agencies dealing with noise have formally adopted DNL, though they also encourage the use of supplemental noise metrics to aid the public in understanding the complex noise environment of an airport. For example, Massport frequently uses the Sound Exposure Level, maximum sound level, or times above threshold sound levels to help describe the environments around Hanscom Field and Logan International Airport. Even so, the Federal Interagency Committee on Noise (FICON), comprised of member agencies such as the FAA, Department of Defense (DoD), U.S. EPA, Department of Housing and Urban Development (HUD), National Aeronautics and Space Administration (NASA), Council on Environmental Quality (CEQ), and the Department of Veterans Affairs, reaffirmed the appropriateness of DNL in 1992. The FICON summary report stated, "There are no new descriptors or metrics of sufficient scientific standing to substitute for

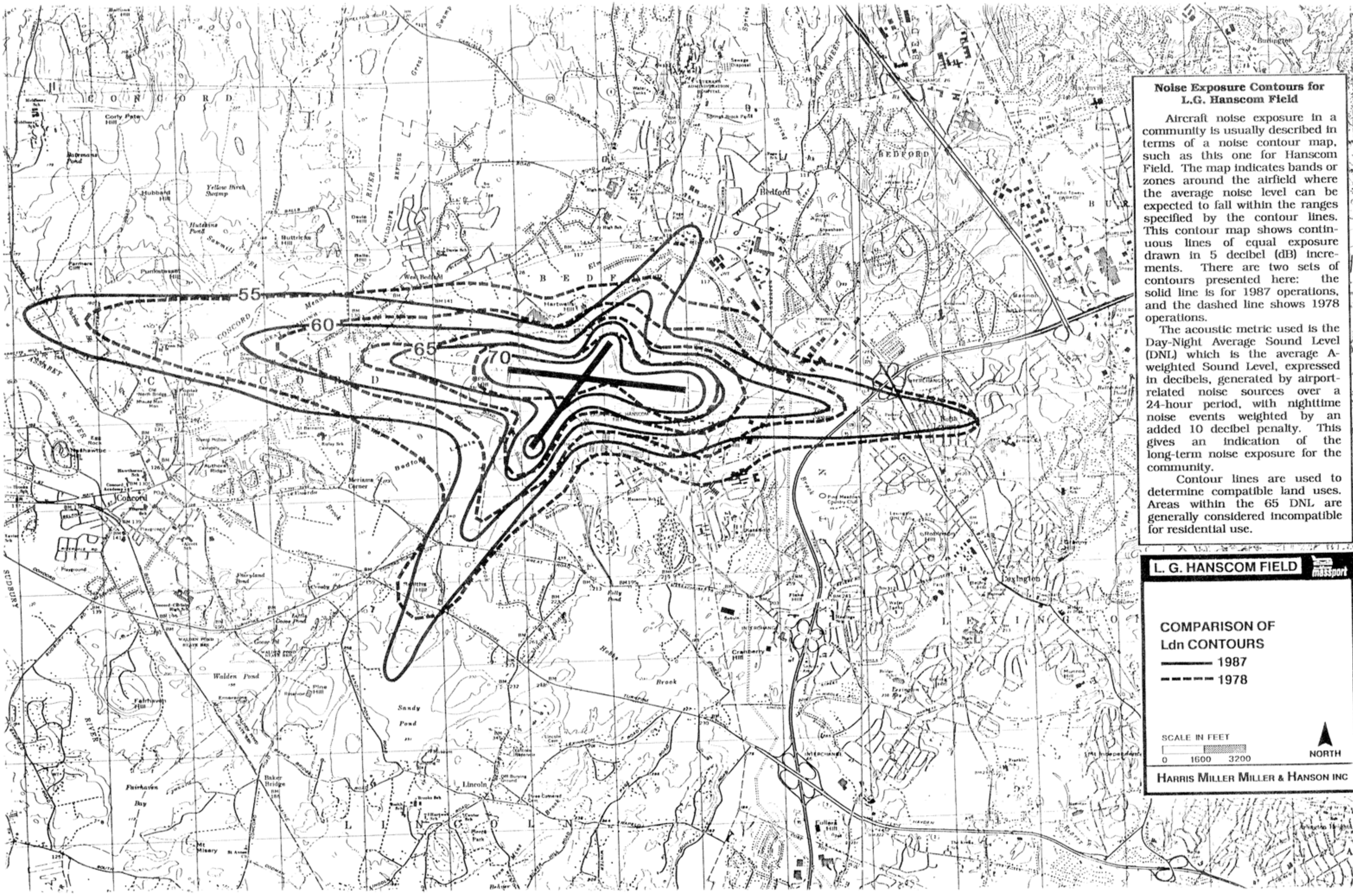
the present DNL cumulative noise exposure metric".[2] The Federal Interagency Committee on Aviation Noise (FICAN) recently supported the use of supplemental metrics in its statement that "supplemental metrics provide valuable information that is not easily captured by DNL".[3]

DNL can be measured or estimated. Measurements are practical only for obtaining DNL values for a relatively limited number of points, and, except in the case of a permanently installed noise monitoring system, only for relatively short time periods. Most airport noise studies are based on computer-generated DNL estimates, depicted in terms of equal-exposure noise contours, much as topographic maps have contours of equal elevation.

Time Above a Threshold, TA

Because analyses of decibels are complex and often unfamiliar to the public, the FAA has developed a supplemental noise metric that is non-logarithmic: the amount of time (in minutes or seconds) that the noise source of interest exceeds a given A-weighted sound level threshold. Every time a noise event goes above a given threshold, the number of seconds is accumulated and added to any previous periods that the noise exceeded the threshold. These time-above-thresholds, or Time Above (TA), are usually reported for a 24-hour period.

Note that TA does not tell the loudness of the various noise events. Just as a single value of the A-weighted sound level ignores the dimension of time, so the TA ignores the dimension of loudness. Nevertheless, TA can be helpful in better understanding a noise environment.



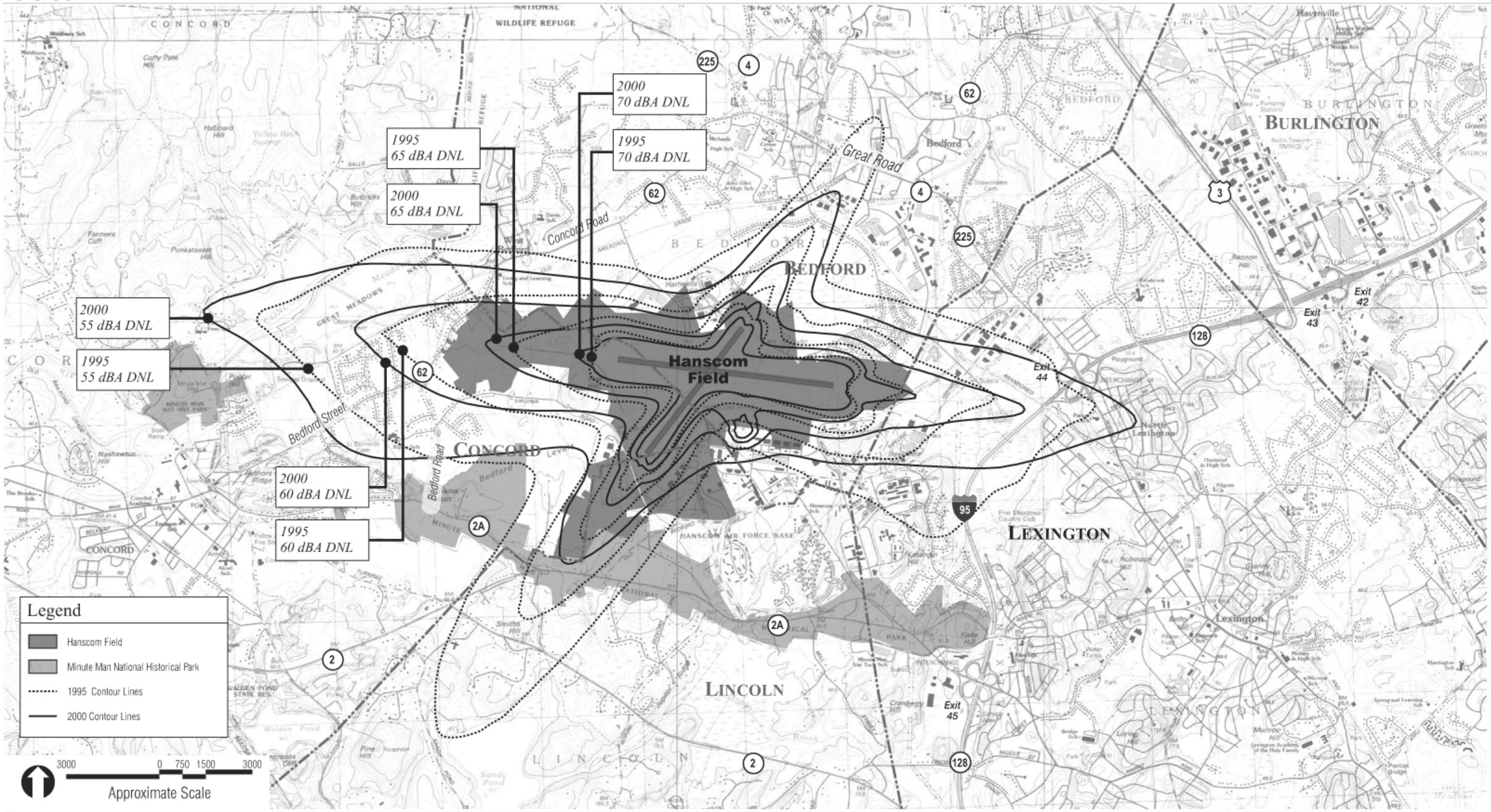
Noise Exposure Contours for L.G. Hanscom Field

Aircraft noise exposure in a community is usually described in terms of a noise contour map, such as this one for Hanscom Field. The map indicates bands or zones around the airfield where the average noise level can be expected to fall within the ranges specified by the contour lines. This contour map shows continuous lines of equal exposure drawn in 5 decibel (dB) increments. There are two sets of contours presented here: the solid line is for 1987 operations, and the dashed line shows 1978 operations.

The acoustic metric used is the Day-Night Average Sound Level (DNL) which is the average A-weighted Sound Level, expressed in decibels, generated by airport-related noise sources over a 24-hour period, with nighttime noise events weighted by an added 10 decibel penalty. This gives an indication of the long-term noise exposure for the community.

Contour lines are used to determine compatible land uses. Areas within the 65 DNL are generally considered incompatible for residential use.

8793_2000_1995_ldn_contours.cdr



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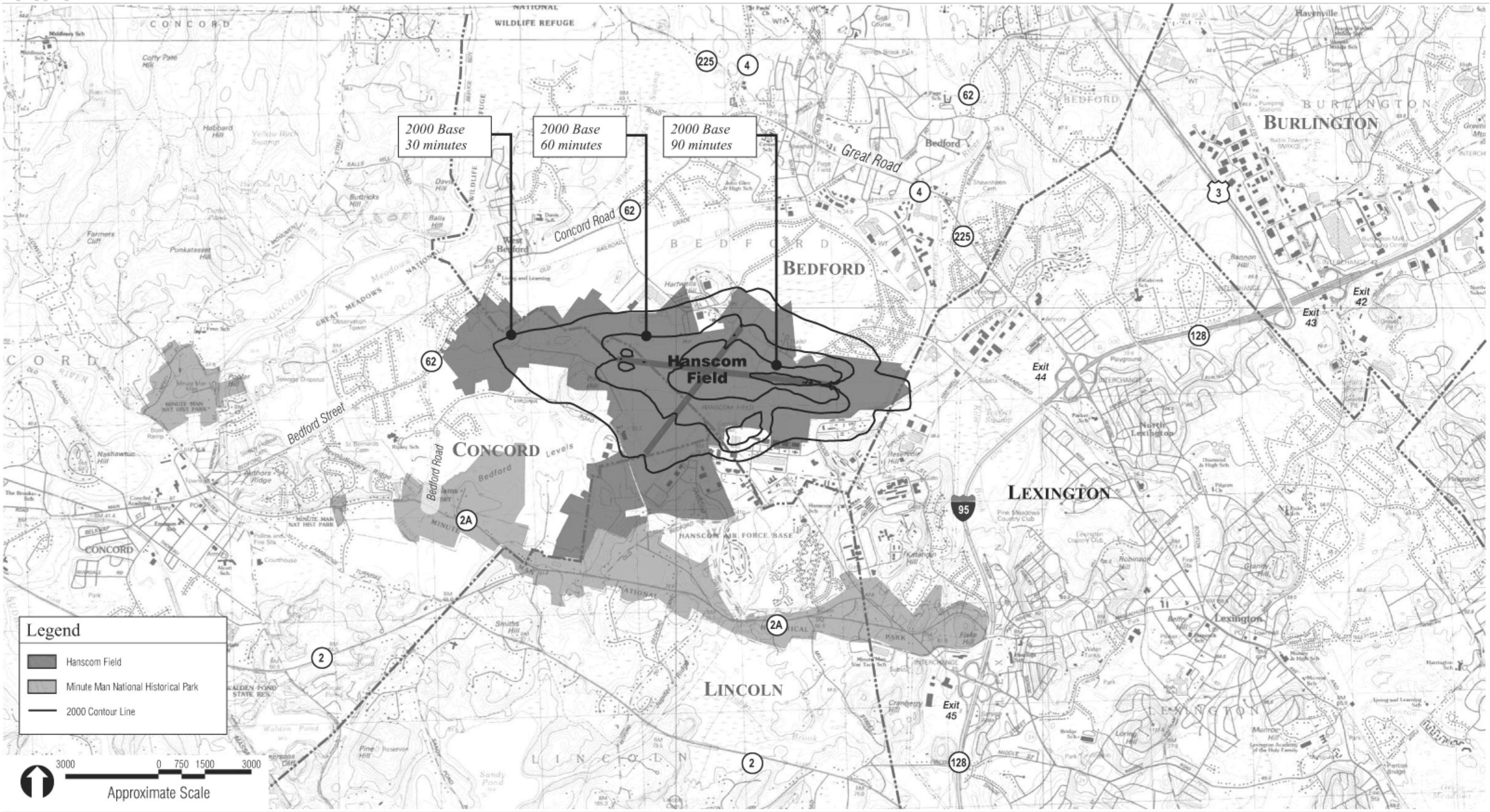
RIZZO
ASSOCIATES
A TETRA TECH COMPANY

Base Map: MA USGS Maps;
MA GIS website, 1996

2000 Hanscom Field Draft ESPR
Bedford, Concord, Lexington and Lincoln, Massachusetts

2000/1995 DNL Contours Figure 7-8



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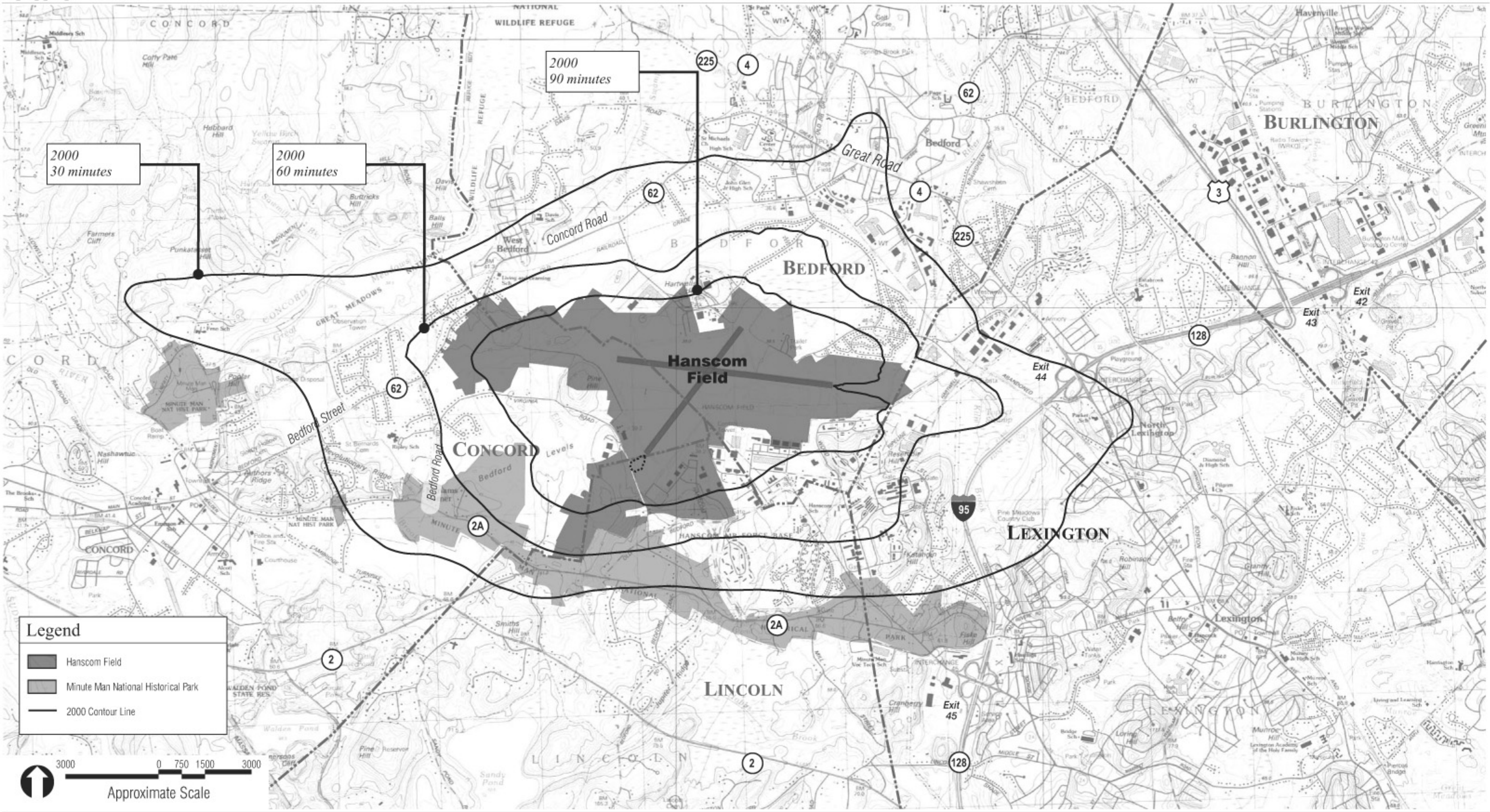
Base Map: MA USGS Maps;
MA GIS website, 1996

2000 Hanscom Field Draft ESPR
Bedford, Concord, Lexington and Lincoln, Massachusetts

2000 Time Above 65 dBA Contours

Figure 7-11

8793_2000_ta_55dba_contours.cdr



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Base Map: MA USGS Maps;
MA GIS website, 1996

2000 Hanscom Field Draft ESPR
Bedford, Concord, Lexington and Lincoln, Massachusetts

2000 Time Above 55 dBA
Contours

Figure 7-12

APPENDIX B

2002 Average Daily Operations and

Noise Exposure by Aircraft Type

Aircraft Group	Representative Types	Reference Dep. SEL: 15,000 ft. from Brake Release (in dB)	DEPARTURES Day	Night 10pm-7am	Total	Partial EXP 6.0c	Reference Arr. SEL: 15,000 ft from Brake Release (in dB)	ARRIVALS Day	Night 10pm-7am	Total	Partial EXP 6.0c
1	C500, C501	87.3	1.16	0.03	1.19	89.2	83.0	1.16	0.04	1.20	85.0
2	MU3, C550, C560	91.9	6.92	0.32	7.24	101.9	84.5	6.82	0.41	7.23	94.9
2M	T47 (MILITARY)	91.9	0.01	0.00	0.01	69.3	84.5	0.01	0.00	0.01	61.9
3	BE40, LR35, LR55, DA10 &200 H25-700 & 800, N265-65	91.2	14.57	0.68	15.25	104.5	85.6	14.50	0.79	15.29	99.1
3M	C-21 (MILITARY)	91.2	0.26	0.00	0.26	85.4	85.6	0.25	0.01	0.26	81.2
4	DA02	95.9	0.34	0.01	0.35	91.9	96.1	0.34	0.01	0.35	92.1
4M	HU25	95.9	0.00	0.00	0.00	0.0	96.1	0.00	0.00	0.00	0.0
5	LR23, 24, 25, N265-40 & 60, H25-40	105.2	0.93	0.04	0.97	106.4	97.5	0.92	0.05	0.97	99.1
5M	T- 37, 38, & 39 (MILITARY)	105.2	0.07	0.00	0.07	93.7	97.5	0.07	0.00	0.07	86.0
6	BAC-111	96.8	0.00	0.00	0.00	71.2	97.1	0.00	0.00	0.00	71.5
7	G3	97.2	0.58	0.04	0.62	97.4	90.6	0.53	0.09	0.62	92.2
7M	C20	97.2	0.03	0.00	0.03	82.0	90.6	0.03	0.00	0.03	75.4
8	G4	82.1	3.08	0.12	3.20	88.4	86.1	3.00	0.20	3.20	93.1
8M	C20B, G4 (MILITARY)	82.1	0.00	0.00	0.00	0.0	86.1	0.00	0.00	0.00	0.0
9	CL60, DA2000, GALX	86.7	4.39	0.22	4.61	94.8	85.0	4.36	0.24	4.60	93.3
10	CL61 & 64	84.6	0.52	0.04	0.56	84.3	86.0	0.53	0.03	0.56	85.2
11	UNKNOWN/MISC JETS (G.A.)	96.7	0.04	0.00	0.04	83.1	99.2	0.04	0.00	0.04	85.6
11M	UNKNOWN/MISC JETS (MIL)	100.4	0.07	0.00	0.07	90.1	90.0	0.07	0.00	0.07	78.4
12	C140 (MILITARY)-obsolete		0.00	0.00	0.00	0.0		0.00	0.00	0.00	0.0
13	C141 (MILITARY)	104.4	0.01	0.00	0.01	81.8	108.2	0.00	0.00	0.00	93.0
14	DC-9	94.4	0.01	0.00	0.01	79.9	91.1	0.01	0.01	0.02	78.9
14M	C9, T-43 (MILITARY)	99.5	0.05	0.01	0.06	89.7	92.2	0.05	0.00	0.05	79.6
15	B707	103.4	0.00	0.00	0.00	0.0	99.8	0.00	0.00	0.00	0.0
15M	C-5A, KC-135, C137 (MIL)	103.4	0.10	0.00	0.10	94.5	99.8	0.10	0.00	0.10	90.0
16	Acft moved to alt. Groups		0.00	0.00	0.00	0.0		0.00	0.00	0.00	0.0
17	HELICOPTERS (G.A.)	83.4	9.58	0.80	10.38	95.8	87.9	9.61	0.77	10.38	100.3
17M	HELICOPTERS (MILITARY)	80.8	0.17	0.00	0.17	73.0	89.4	0.17	0.00	0.17	81.6
18	G159, CV60 - HVY TURBOS	89.8	0.01	0.00	0.01	71.2	94.6	0.01	0.00	0.01	76.0
18M	C130 - HVY TURBOS (MILITARY)	93.0	0.16	0.00	0.16	85.1	93.5	0.16	0.00	0.16	85.6
19	BE20,30 - TURBOS	81.9	6.05	0.12	6.17	90.5	91.1	6.05	0.14	6.19	99.8
19M	C12, T44, C26 - TURBOS (MIL)	81.9	0.56	0.02	0.58	80.6	91.1	0.56	0.02	0.58	89.8
20	TWIN PISTON - BE56, C310 (G.A.)	82.6	7.15	0.24	7.39	92.4	83.7	7.16	0.21	7.37	93.4
20M	TWIN PISTON - C45,T42 (MIL)	82.6	0.01	0.00	0.01	60.0	83.7	0.00	0.00	0.00	68.5
21	SINGLES - INC. LOCALS (G.A.)	78.2	219.79	0.15	219.94	101.7	79.4	219.29	0.65	219.94	102.9
21M	SINGLES (MILITARY)	78.2	0.00	0.00	0.00	52.6	79.4	0.00	0.00	0.00	53.8
22	WW24, WW25	90.9	1.25	0.03	1.28	92.9	82.5	1.23	0.05	1.28	85.0
23	FK28	98.5	0.00	0.00	0.00	0.0	95.6	0.00	0.00	0.00	0.0
24	A-4,6, F-14,15,16,18 (MIL)	112.7	0.18	0.00	0.18	105.1	91.2	0.18	0.00	0.18	83.6
25	C650	88.8	1.41	0.05	1.46	91.7	82.5	1.39	0.07	1.46	85.8
26	DA50, DA90	93.0	2.74	0.10	2.84	98.8	87.4	2.67	0.18	2.85	93.9
27	CV58 - TURBO	81.9	0.00	0.00	0.00	0.0	91.5	0.00	0.00	0.00	0.0
28	DC3, CV24 - HVY TWIN PISTONS	94.7	0.01	0.01	0.02	82.7	95.6	0.01	0.00	0.01	77.0
28M	DC3 - HVY TWIN PISTONS (MIL)	94.7	0.00	0.00	0.00	69.1	95.6	0.00	0.00	0.00	70.0
29	AC6T, BE90, PA31T - TURBOS	75.3	2.78	0.09	2.87	81.0	81.9	2.75	0.12	2.87	87.9
30	SF34 - TURBO	77.3	8.42	0.17	8.59	87.3	84.0	8.04	0.56	8.60	95.3
31	B727 (STAGE 2)	105.6	0.00	0.00	0.00	0.0	95.5	0.00	0.00	0.00	0.0
32	B727 (STAGE 3)	103.8	0.12	0.09	0.21	104.1	94.8	0.12	0.11	0.23	95.7
33	BEST, ND26 - TURBOS	82.9	0.00	0.00	0.00	67.7	85.4	0.00	0.00	0.00	70.2
34	B737	95.4	0.24	0.07	0.31	95.1	91.8	0.18	0.13	0.31	93.4
35	DH8	70.3	0.97	0.01	0.98	70.4	81.1	0.96	0.02	0.98	81.5
36	A320, A319	89.4	0.00	0.00	0.00	0.0	91.1	0.00	0.00	0.00	0.0
37	GLEX, G5	86.2	0.82	0.04	0.86	87.0	86.5	0.80	0.09	0.89	88.9
37M	C37, G5	86.2	0.00	0.00	0.00	0.0	86.5	0.00	0.00	0.00	0.0
38	SBR1-80	95.9	0.04	0.00	0.04	82.3	96.0	0.04	0.00	0.04	82.4
39	G2	99.6	0.65	0.06	0.71	100.7	92.3	0.58	0.13	0.71	95.0
40	C750	82.0	1.68	0.08	1.76	85.8	89.1	1.58	0.17	1.75	94.2
41	B738	87.2	0.04	0.00	0.04	73.0	92.6	0.04	0.00	0.04	78.4
TOTALS											
	CIVILIAN W/O SINGLES		76.50	3.46	79.96	112.0		75.47	4.61	80.08	108.5
	CIVILIAN W/SINGLES		296.29	3.62	299.91	112.4		294.76	5.27	300.03	109.5
	MILITARY		1.66	0.03	1.69	106.1		1.66	0.04	1.70	97.3
	TOTAL W/O SINGLES		78.16	3.50	81.66	113.0		77.13	4.64	81.77	108.8
	TOTAL W/SINGLES		297.95	3.65	301.60	113.3		296.42	5.30	301.72	109.8

APPENDIX C

1999 through 2002 Measured Ldn (dBA)

at

Hanscom Noise Monitoring Sites

Hanscom Sites
Noise Summary
Measured Ldn (dBA)

RMS ID	Location Description	Jan'99	Feb '99	Mar '99	Apr '99	May '99	Jun '99	Jul '99	Aug '99	Sep '99	Oct '99	Nov '99	Dec '99	**1999**
Month														
31	Concord Localizer	65.4	66.0	68.6	67.1	65.3	65.5	65.0	66.5	67.8	70.1	68.9	67.7	67.3
32	Bedford Localizer	62.9	62.5	64.9	63.9	62.8	63.6	64.5	63.3	63.6	63.5	64.9	63.6	63.8
33	Lincoln--Brooks Rd	54.7	55.2	56.4	55.8	55.9	56.3	56.1	57.8	57.5	56.7	55.9	55.0	56.2
34	Bedford--DeAngelo	58.5	58.4	59.4	59.1	59.4	60.2	60.2	61.6	59.5	59.8	59.7	58.7	59.6
35	Lexington--Preston	59.3	59.3	60.1	60.4	59.4	58.3	59.3	59.9	59.8	60.9	61.4	60.7	60.0
36	Concord Wastewater	61.3	62.4	62.6	62.1	62.0	62.0	63.0	63.5	64.1	64.3	64.2	64.2	63.1

RMS ID	Location Description	Jan '00	Feb '00	Mar '00	Apr '00	May '00	Jun '00	Jul '00	Aug '00	Sep '00	Oct '00	Nov '00	Dec '00	**2000**
Month														
31	Concord Localizer	67.6	65.9	66.3	66.0	66.8	65.5	65.8	65.9	66.8	67.9	66.9	65.2	66.5
32	Bedford Localizer	62.5	62.9	64.5	63.8	66.5	63.0	62.6	64.8	63.9	66.0	66.6	64.4	64.5
33	Lincoln--Brooks Rd	54.6	54.9	56.1	56.4	56.2	57.8	55.8	56.0	55.7	54.7	54.8	54.6	55.7
34	Bedford--DeAngelo	58.8	58.7	59.7	60.4	59.8	60.3	60.4	60.2	59.8	59.9	59.9	58.6	59.7
35	Lexington--Preston	59.7	59.3	60.5	60.6	60.1	59.4	58.8	60.2	60.7	61.1	61.1	60.7	60.2
36	Concord Wastewater	63.3	63.3	63.6	63.3	63.1	63.3	62.2	61.8	62.5	62.8	62.3	62.1	62.8

RMS ID	Location Description	Jan '01	Feb '01	Mar '01	Apr '01	May '01	Jun '01	Jul '01	Aug '01	Sep '01	Oct '01	Nov '01	Dec '01	**YTD 2001**
Month														
31	Concord Localizer	65.4	65.3	66.7	66.9	64.5	65.6	66.5	65.1	64.4	66.8	67.7	66.2	66.0
32	Bedford Localizer	63.0	64.2	65.3	66.5	64.4	63.6	62.5	65.2	63.8	63.9	66.4	64.3	64.6
33	Lincoln--Brooks Rd	52.9	53.2	54.3	55.9	57.5	56.7	56.2	58.1	55.5	54.0	54.4	54.6	55.6
34	Bedford--DeAngelo	57.8	58.1	58.0	60.5	60.3	60.8	60.4	61.5	60.8	60.5	61.4	62.8	60.5
35	Lexington--Preston	59.8	60.2	60.6	60.0	59.9	59.1	59.0	58.9	59.0	60.1	60.5	59.8	59.8
36	Concord Wastewater	59.8	61.6	62.2	63.4	61.6	62.0	61.7	62.1	61.9	62.1	62.1	63.7	62.1

RMS ID	Location Description	Jan '02	Feb '02	Mar '02	Apr '02	May '02	Jun '02	Jul '02	Aug '02	Sep '02	Oct '02	Nov '02	Dec '02	**YTD 2002**
Month														
31	Concord Localizer	67.4	66.3	66.7	68.0	68.0	70.4	66.2	63.6	66.6	68.0	66.9	66.4	67.3
32	Bedford Localizer	65.3	65.0	64.8	65.9	66.9	67.8	63.6	63.6	64.8	67.2	65.7	63.3	65.5
33	Lincoln--Brooks Rd	54.7	57.0	56.9	56.2	56.1	58.7	56.8	57.2	57.6	55.9	56.0	54.3	56.6
34	Bedford--DeAngelo	60.7	62.2	61.0	61.6	60.9	62.0	61.2	61.2	61.5	60.1	61.3	60.2	61.2
35	Lexington--Preston	59.6	59.7	58.3	61.5	61.8	64.3	59.1	59.1	59.4	59.8	59.2	58.9	60.4
36	Concord Wastewater	61.1	60.9	61.6	62.1	61.9	61.8	60.5	60.7	60.5	61.3	61.2	62.7	61.4

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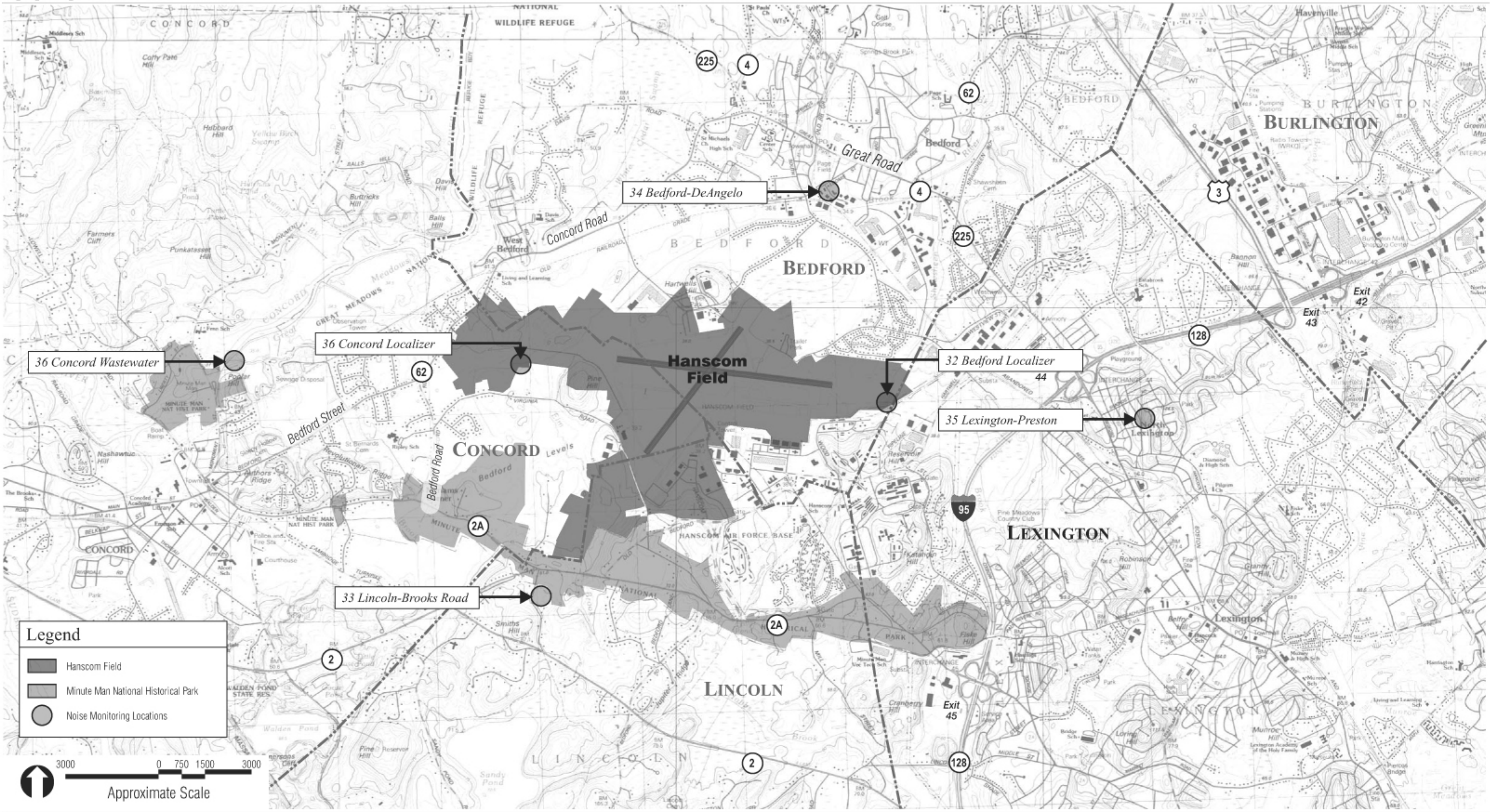

2000 Hanscom Field Draft ESPR
Bedford, Concord, Lexington and Lincoln, Massachusetts

massport

RIZZO ASSOCIATES
A TETRA TECH COMPANY

Base Map: MA USGS Maps;
MA GIS website, 1996

Noise Monitoring Locations

Figure 7-9